

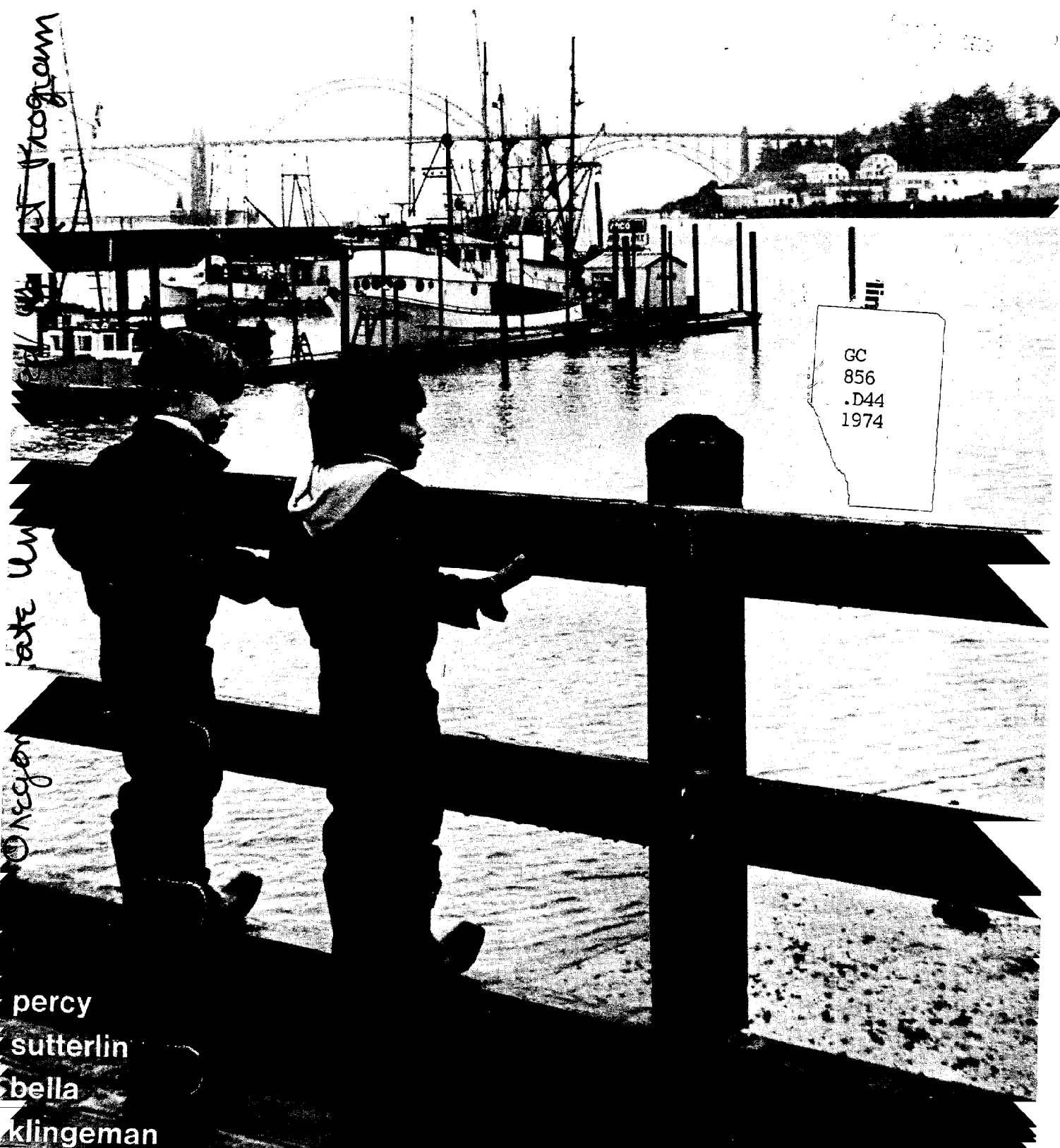
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OREGON'S ESTUARIES



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DESCRIPTIONS AND INFORMATION SOURCES

FOR

OREGON ESTUARIES

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PREFACE

This report is a second expanded edition of a previous edition entitled "Description and Information Sources for Oregon's Estuaries," March 1973. The study leading to this second edition has been sponsored by the Office of Water Resources Research, United States Department of the Interior administered through the Water Resources Research Institute, Oregon State University.

The first edition was performed as part of a study for the Oregon Study Team of the Pacific Northwest River Basins Commission under contract with two of the member agencies of the study team: the U.S. Army Corps of Engineers and the National Oceanic and Atmospheric Administration. Concepts and recommendations developed under this study are included in the report "General Planning Methodology for Oregon's Estuarine Natural Resources," Pacific Northwest River Basins Commission, P.O. Box 908, Vancouver, WA, 98660. The interested reader can also refer to the technical publications by the principal investigators for more recent research on the environmental management of Oregon's Estuaries.

The support and cooperation of a great number of individuals and organizations is acknowledged. Particular acknowledgment is given to James B. Kennedy who served as Resource Coordinator for a portion of the study. The professional assistance of Larry S. Slotta and Charles K. Sollitt, Department of Civil Engineering, Oregon State University is greatly appreciated.

The appreciable support of the Oregon Coastal Conservation and Development Commission, particularly James F. Ross, Executive Director, and Wilbur Ternyik, Chairman, and of Paul Coyne, President of the Oregon Coastal Ports Federation, in obtaining information and in arranging meetings to exchange ideas with numerous knowledgeable individuals from state agencies, port authorities, coastal towns and counties is gratefully acknowledged.

Considerable help and information was also provided by many other individuals whose assistance is collectively acknowledged here. Mrs. Elisabeth Schafer and Ms. Kathie Zuleger prepared this report through several drafts and numerous revisions.

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INTRODUCTION

Information concerning the physical, chemical, and biological characteristics of Oregon's estuaries and of the natural resources found within them has not been available in complete form from any one agency, group or publication. Partial information can be obtained from many different sources if the planner or decision maker knows whom to ask and where to look.

This report, while not a complete compilation of facts about the natural resources and related features of Oregon's estuaries, provides a summary of much of the known information about the estuaries and gives numerous citations of literature and agencies from which supporting information may be obtained. The report is intended to provide the planner with a "starting point" for assembling the required data concerning most of the Oregon estuaries.

Oregon Estuaries

Oregon's recognized estuaries, reportedly 14 in number [149,155], are shown in Figure A, together with some of the state's smaller estuaries. Also shown are the five basins into which the coastal zone is commonly divided--the North Coast, Mid-Coast, Umpqua River, South Coast, and Rogue River basins. These basins are mentioned periodically herein and are included in Figure A to give a general indication of their boundaries and of the estuaries included within them. Thirteen major Oregon estuaries are described in this report. However, the Columbia River estuary which is the largest estuary, is an interstate estuary of a multi-state drainage basin and has been omitted. Information is organized as individual estuary reports with the same basic format for each. The outline used is presented in the following pages with descriptions and explanations of the information and major references being given as necessary. Definitions are included at the end of this section. References, which are indicated by brackets ([]) are included in alphabetical order at the end of this report.

General Description of Estuary and Drainage Basin

Estuary

Listed in this section are the location, population, centers, dimensions, and major tributaries of each estuary. Also given are addresses and phone numbers of Port Commissions [106] and other organizations having a special interest in the area. Mention is made of any existing physical models⁽¹⁾ or special reports.

(1) Records of physical models were found for Tillamook and Umpqua Bays only.

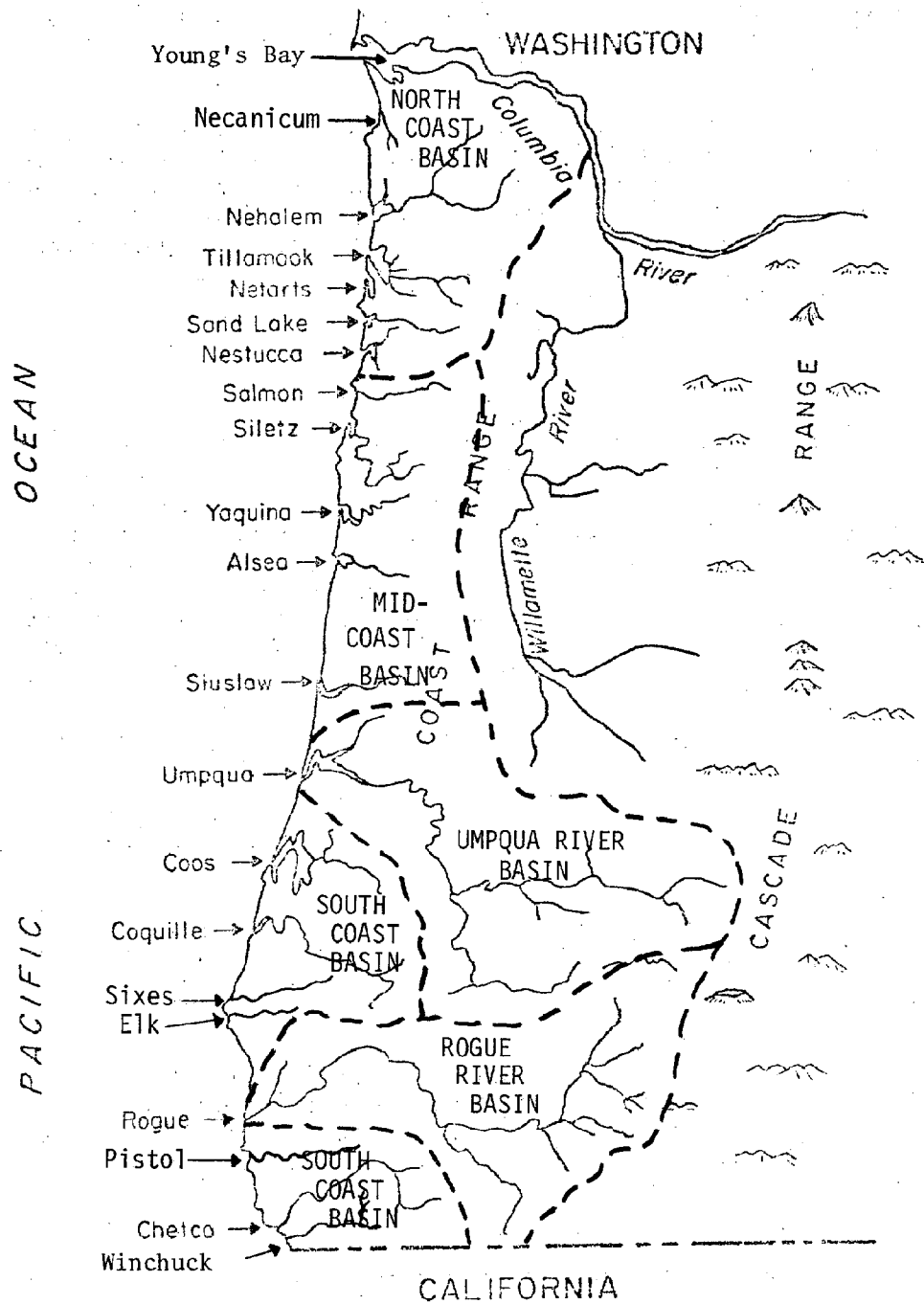


Figure A. Oregon's estuaries and major coastal drainage basins.

For comparison, the estuaries are shown in Table A in order of decreasing estuary size, along with surface areas, percent tidelands, and size of drainage basins as presented in various sources. This information is also given in the individual reports.

Table A. Surface areas, percent tidelands, and drainage areas of Oregon's estuaries [55,59,70].

| Estuary | Surface area (acres) measured at | | | Percent of surface areas which is tidelands | | Drainage basin area (sq.mi.) |
|--------------|-------------------------------------|-------------|--------------------|---|------|------------------------------------|
| | HW [55] | MHT [70] | | [59] | [70] | |
| Coos | 10,973 | --- | 9,543 ^a | 48 | -- | 605 |
| Tillamook | 8,861 | 8,289 | 8,839 ^a | 58 | 50 | 540 |
| Umpqua | 6,749 | 6,830 | 5,712 ^a | 27 | 22 | 4,560 |
| Yaquina | 4,233 | 3,910 | 2,853 ^a | 61 | 35 | 253 |
| Youngs Bay | --- | --- | 2,870 ^b | -- | -- | 122 |
| Nehalem | 2,388 | 2,309 | 3,766 ^a | 32 | 47 | 855 |
| Netarts | 2,179 | 2,325 | 2,406 ^a | -- | 65 | 14 |
| Alsea | 2,140 | 2,146 | 2,227 ^a | -- | 46 | 474 |
| Siuslaw | 1,458 | 2,245 | 1,589 ^a | 38 | 34 | 773 |
| Siletz | 1,086 | 1,187 | 1,203 ^a | -- | 65 | 373 |
| Nestucca | 1,022 | 1,000 | 1,149 ^a | -- | 58 | 322 |
| Coquille | 818 | --- | 703 ^a | -- | -- | 1,058 |
| Rogue | 575 | --- | --- | -- | -- | 5,100 |
| Sand Lake | 429 | 528 | 700 ^a | -- | 75 | 17 |
| Sixes | --- | --- | 330 ^d | -- | -- | 129 |
| Elk | --- | --- | 290 ^d | -- | -- | 94 |
| Necanicum | --- | --- | 278 ^c | -- | -- | 87 |
| Pistol | --- | --- | 230 ^d | -- | -- | 106 |
| Salmon River | 171 | 204 | 438 ^a | 57 | 62 | 75 |
| Chetco | 140 | --- | --- | -- | -- | 359 |
| Winchuck | --- | --- | 130 ^d | -- | -- | 70 |

^aTidal stage not given -- described as "those areas affected by tidal action." [59]

^bArea calculated by planimeter -- shoreline representing approximate line of mean high water. [116]

^cTidal stage not given -- described as "the estuary covers 278 acres." [66]

^dArea calculated by planimeter from aerial photographs -- Tidal stage not known. [135]

Population centers considered here are those located on or near the estuary (i.e., near water subject to tidal influence or near the head of tidewater.) In cases where the extent of tidal influence was not known, population centers within a reasonable distance from the estuary mouth (assumed to be 1 to 10 miles, depending on the estuary) were included. The centers are given in table form for most estuaries and were taken from three sources--(1) the 1972 Rand McNally and Co. Atlas [111], (2) the Oregon State Water Resources Board (OSWRB) basin report maps [88,89,93,99], and (3) the OSWRB stream mile summaries [94,95,96,97]. The Rand McNally Atlas [111] either provided the 1970 census figures or used the terms "rural" and "no pop," defined in the atlas as follows:

no pop--most of these places are railroad stations, but some are factories, mines, power plants, etc.
The "no pop" designation indicates that the place is in the open country and is not associated with any settlement.
rural--open-country localities that have a locally recognized name, although no built-up section exists and the population is scattered over a wide area.

Towns shown on a map or listed in a stream mile summary but for which census figures were not given are described here as "not listed."

Estuary surface areas are from work by Marriage [59], Johnson [55], the Division of State Lands [70], and Department of Water Resources, OSU [87]. Marriage did not specify the tidal stage for which he gave the areas but did state that "only those areas affected by tidal action were included in the acreage measurements." He determined the areas sometime around 1948 from either U.S. Coast and Geodetic Survey (USCGS) bay charts (preferably) or coastal charts, but made no indication as to which type was used for the individual estuaries. In most instances he also gave the number of tideland acres. Johnson apparently used USCGS charts from the late 1960's and early 1970's for determining surface areas and other dimensions presented here, such as distance to farthest estuary shore, inlet dimensions at throat, and average lagoon depth below MSL. The Division of State Lands, the most recent of the three references, obtained MLT and MHT surface areas by planimeter measurements taken from aerial photographs on which estuarine boundaries at those tidal stages had been marked by direct observation. That agency has also compiled a tideland abstract listing the acreage of most Oregon estuary tidelands as well as some ownership and deed information [70]. The State of Oregon Division of State Lands provided most of the maps at the beginning of each section, the others being U.S.G.S. and U.S. Army Corps of Engineers maps.

Major tributaries are described in terms of length, annual fresh water yield, and drainage areas. Some indication is also made of the location of the point for river mile zero as given in the OSWRB stream mile summaries [94,95,96,97] or basin reports maps [88,89,93,99]. In some cases the major tributary has its zero river mile at the estuary mouth, and therefore, the lower section of the river actually is the estuary (or at least its major portion). Yaquina Bay provides an example of this type of stationing. In other cases (e.g., Nestucca Bay) the zero river mile stations of major tributaries are at their points of discharge into the "bay." In instances such as this, an attempt was made to estimate (from the OSWRB maps) the distance along the center of the estuary from its mouth to the zero river mile.

In any case such as the above, where a distance was estimated and is therefore very approximate, it is so designated here by simply describing it as being approximately or about the indicated number of miles. Unless otherwise stated statute miles are used.

The Estuaries of Oregon are now and have been in the past regions of rich resources for the inhabitants of the coast. For this reason those lands adjacent to the estuaries have been used for thousands of years by prehistoric inhabitants as occupation areas. There are state and federal laws which protect these archeological resources on all public lands. Inquiries concerning these laws and archeological sites should be directed to the Museum of Natural History, University of Oregon, Eugene, Oregon [22]. The Museum is by state law the protector of state antiquities and the repository of information concerning antiquities.

This information has not been mentioned in the individual reports.

Drainage Basin

Drainage basin area, annual fresh water yield, composition (percentage of forests, croplands, rangelands, etc.), annual precipitation, air temperature, wind direction, and range of elevation are included in this section. It should be noted that the terms "drainage basin" and "watershed" are used interchangeably.

Areas of the drainage basins are mainly those presented in the OSWRB stream mile summaries [94,95,96,97]. In cases where no area was found, estimates were made from the OSWRB basin reports maps [88,89,93,99].

In 1968, the OSWRB made available information in punch card or printout form from surface water gaging stations for which monthly and water-year runoff records had been compiled. A description of the format used and a listing of the stations from which records would be provided are given in a publication by the agency entitled "Surface Water Gaging Stations, Oregon" [98]. Some of those stations are also noted here in the table of surveillance stations included at the end of each estuary section.

Precipitation records are available for towns on many of the estuaries [92,143]. Wind roses can be obtained for some areas [7]. Also, it has been generalized that along the Oregon coast, winter winds are predominantly from the southwest and summer winds are from the northwest to north [7].

Hydraulic Description of Estuary

Tides and Currents

Information given here includes exposure of the estuary to waves at the mouth [55]; the extent of tidal influence (various references); mean tide range⁽²⁾ and its diurnal range [55]; the extreme tidal range [86]; tidal prism on mean range and its diurnal range [55]; amplification information [43]; and phase difference between tidal elevations and tidal currents [43].

(2) "The mean tide range as listed was taken from the 1971 USC&GS Tide Tables for the station inside the bay or lagoon nearest to the entrance." [55].

Two items of information that can be given for this entire coastal area (and have therefore not been repeated in the individual reports) are that (1) tides are "mixed," meaning two unequal high tides and two unequal low tides daily, and (2) wave roses are available through the U.S. Army Corps of Engineers.

River Discharges

Where possible, observed or estimated flow rates of major tributaries are given. The U.S. Geological Survey (USGS) operates numerous stream gaging stations and annually presents records from them in its publication "Water Resources Data for Oregon, Part I. Surface Water Records" [140].

Salinity and Classification by Mixing

Most salinity information was taken from research conducted by Burt and McAllister during the late 1950's [12,13].

Determination of the extent of salinity intrusion involved up to only nine measurements being made over a two-year period [12]. These were taken along the channel centerline at various distances from the ocean. Concentrations presented here are those from the sampling point showing greatest inland intrusion.

In classifying estuaries on the basis of mixing characteristics, Burt and McAllister used the following distinctions, previously defined by Pritchard⁽³⁾, in terms of salinity change from top to bottom [13]:

two-layered system--20 ppt or over
partly-mixed system--between 4 ppt and 19ppt
well-mixed system--3 ppt or less.

Classification was made for various months from HW measurements taken at the nearest station where mean salinity was 17 ppt (roughly half fresh and half salt water). It should be noted that, as Burt and McAllister pointed out, an estuary will probably change from one type to another as conditions vary throughout the year. Examples of this situation can be seen repeatedly in the individual reports.

Sediments

Given in this section is information and reference material on littoral drift, sediment loads, and analyses of dredge samples.

Littoral drift along the Oregon coast seems, in most cases, to be to the south during the summer and to the north during the winter, with the net drift being to the south [57]. However, proximity to the mouth of the Columbia River may be a significant factor regarding predominant drift direction.

(3) Pritchard, D.W., "Estuarine Circulation Patterns," Proc. Am. Soc. Civil Eng., Vol. 81, Separate 717, pp. 1-11, 1955.

Estimates of sediment loads were made [85] from a map presented by H.W. Anderson in 1954⁽⁴⁾. Conditions of the watersheds have changed considerably since then, and the generalized estimates can no longer be considered to be as reliable as they once may have been.

The U.S. Army Corps of Engineers has analyzed dredge samples to determine organic content, void ratio, and grain size [124]. In most cases, this involved several samples; however, the data given here include only the mean grain size and the extreme values of organic content and void ratio, with some indication of the sampling date and site. More information could be obtained from the Corps records.

The amount of accretion at jetties of some of the estuaries has been given in the Division of State Lands tideland abstract previously mentioned [70]. That information, which is not repeated in the individual reports, is as follows: Nehalem--115 feet S; Siuslaw--320 feet N, 55 feet S; Tillamook--250 feet N, 70 feet S; Umpqua--245 feet N, 12 feet S.

Water Quality

The Department of Environmental Quality (DEQ) operates numerous water surveillance stations and will provide records from them in punch card or printout form showing temperature, pH, salinity, dissolved oxygen (DO), biochemical oxygen demand (BOD), Pearl-Benson Index (PBI), turbidity, total coliforms, and fecal coliforms [67,68]. Initial measurements in some estuaries were made as far back as 1957 (Coos and Umpqua) whereas for others they are only as recent as 1969 (Alsea and Siletz). No attempt was made to review the records and summarize them here; only the number of stations with their locations and periods of records are given.

Temperature or other water quality measurements from stations other than those operated by the DEQ are also mentioned. In most cases, these are USGS stations, the records from which are available in annual USGS publications, "Water Resources Data for Oregon. Part II. Water Quality Records" [141].

Descriptions of some sewage treatment facilities are given, but the information is incomplete because not all of the treatment plants in any given estuarine area are necessarily covered. Industrial outfall information is not easily accessible at this time, but the DEQ is now issuing permits and is in the process of putting the rate and type of discharge at the outfalls on punch cards. By the fall of 1973 the project will possibly be to the point where the information will be readily available [44].

(4) Anderson, H.W., "Suspended Sediment Discharge as Related to Streamflow, Topography, Soil, and Land Use," Transactions, American Geophysical Union, Vol. 35 (2) pp. 268-281, 1954.

Biological Information

In this section, mention is made of as least some of the fish, water-fowl, and big game animals commonly found in each estuarine area. Listings of fish generally include only those which are of either commercial or recreational interest. Estimates of the number of anadromous salmonids spawning in various streams as presented in the Oregon State Game Commission (OSGC) basin environmental investigations are given in the individual reports and compiled for comparison in Table B [75,76,77,78,79]. Also available in these publications are periodicity charts and distribution maps for anadromous fish.

Table B. Estimated numbers of adult anadromous salmonids spawning in the Oregon estuarine stream systems, 1972 [75,76,77,78].

| | Stream system | Chinook | | Coho | Chum | Steelhead | | Sea-run Cutthroat |
|-------------|--|---------|--------|----------------|-------|-----------|--------|----------------------|
| | | spring | fall | | | winter | summer | |
| North Coast | Nehalem River ^{1,3} | --- | 4,000 | 21,840 | 200 | 11,000 | --- | 8,000 |
| | Tillamook (Tillamook, Trask, Wilson, Kilchis, and Miami Rivers) ^{1,3} | 6,120 | 33,705 | 33,625 | 9,900 | 49,575 | 2,400 | 18,000 |
| | Netarts | | | no information | | | | |
| | Sand Lake | | | no information | | | | |
| | Nestucca (Nestucca and Little Nestucca Rivers) ^{1,3} | 1,890 | 20,565 | 18,580 | 2,000 | 37,290 | 5,600 | 5,800 |
| | Necanicum ¹ | --- | --- | 3,780 | 100 | 2,000 | -- | 2,000 |
| | Youngs Bay ¹ | --- | 500 | 17,200 | 200 | 2,800 | -- | 1,000 |
| Mid-Coast | Salmon River ^{1,2,3} | 180 | 2,000 | 5,700 | | 4,200 | 250 | 3,800 |
| | Siletz ^{1,2,3} | 775 | 14,200 | 26,900 | | 11,500 | 4,900 | 32,000 |
| | Yaquina ^{1,2,3} | 0 | 2,100 | 12,600 | | 2,300 | 0 | 7,500 |
| | Alsea ^{1,2,3} | 300 | 20,000 | 58,000 | | 13,600 | 200 | 28,600 |
| | Siuslaw ^{1,2,3} | 0 | 4,500 | 22,000 | | 13,000 | 0 | 50,000 |
| Umpqua | Umpqua ^{3,4} | 12,600 | 5,000 | 25,000 | | 40,000 | 12,000 | 30,000 |
| Rogue | Rogue ¹ | 45,500 | 75,000 | 5,000 | 50 | 75,500 | 51,250 | 5,300 |
| South Coast | Coos ^{1,2,3} | 0 | 500 | 8,300 | | 5,000 | | 3,500 |
| | Coquille ^{1,2,3} | 50 | 4,900 | 23,000 | | 16,100 | | 12,000 |
| | Sixes ¹ | --- | 3,000 | 300 | | 2,500 | | 3,000 |
| | Elk ¹ | --- | 3,200 | 800 | | 3,500 | | 2,800 |
| | Pistol ¹ | --- | 500 | 50 | | 1,200 | | 4,000 |
| | Chetco ¹ | --- | 3,000 | 500 | | 4,000 | | 2,500 |
| | Winchuck ¹ | --- | 400 | 50 | | 1,500 | | 1,500 |

¹ Estimates by OSGC and FCO biologists.

² Numbers indicate spawning escapement. Total run would be computed by adding appropriate sport and commercial harvest data.

³ Estimates include hatchery contributions.

⁴ Estimates by OSGC.

The charts and maps are not presented here, but much of the other information for this section was taken from those references. In the case of the Coquille River, the preliminary report [81] used in preparing a portion of the South Coast Basin investigation [78] was supplied by the OSGC. Similar papers on the other estuaries were not available, although they apparently had been written.

Physical Alterations

Physical modifications such as jetties, channel projects, and landfills are described here. Some dredging records and project (channel) use statistics are also given, and a listing is made of fishways and hatcheries.

All jetty and channel projects are under the jurisdiction of the U.S. Army Corps of Engineers and records of such modifications are open to the public. Information used here was taken from a Corps water resources development report [129] and to a lesser degree from a fairly detailed unpublished 1971 reference entitled "Study and Maintenance Dredging Coastal Harbor Estuaries" [128]. Reports by the Chief of Engineers dating back to 1866 (when the Corps first became responsible for the maintenance of Pacific Coast Harbors) are available as annual publications.

It is presently the duty of the Corps to maintain harbors for use by ocean going vessels. This consists of maintaining or improving channels and maintaining, improving, or constructing jetties and breakwaters. References used here were written up with a description of the "existing project" (i.e., the authorized project) followed by completion dates of the various phases. In some instances, difficulty arose in determining exactly what had and had not been constructed. For that reason, some completion dates may be lacking here, but (as noted in the individual reports) that does not mean the modification has not been completed, but only that records of such were not found. More detailed information could be obtained directly from the Corps in Portland.

Statistics of channel use are from the Corps water resources development report [129]. Dredging records, taken from the Chief of Engineers Annual Report and presented by Johnson [55] for 1959 to 1969 (excluding 1968), list the quantity (in cu yds) removed from each estuary. The dredged amounts presented here are "typical quantities," meaning those that appeared to be close to the average amount removed during the 1959 to 1969 period.

The Oregon Division of State Lands has completed inventories of filled lands in many Oregon estuaries [69] with individual reports being made available as each estuary inventory is completed. The reports give a general description of the estuary and its drainage basin with information on landfills such as location, ownership, construction dates, usage, permit number, and areas. Some of that information is presented in Table C and also in the reports on the Siuslaw, Umpqua, and Sand Lake estuaries. Navigable lengths of some of the estuary tributaries, provided to the Division of State Lands by the Corps of Engineers, are also given in those landfill inventories and have been presented here in the individual estuary reports.

Table C. Information on landfills in Oregon estuaries [69].

| estuary | landfill area (acres) | | | use/ownership | main location |
|------------------------|---|-----------------------------------|--------|---|---|
| | on submerged lands ¹ | on submersible lands ² | total | | |
| Alsea | 0 | 24.75 | 24.75 | marine oriented; heavy emphasis on recreation | east side of Waldport |
| Nehalem | 20.11 | 7.27 | 27.38 | residential or recreation oriented; generally small fills | Brighton, Wheeler, and Nehalem areas |
| Nestucca | 0.15 | 0.68 | 0.83 | erosion control on residential property; mainly state owned | Pacific City; Woods area; between miles 1.5 and 2.5 |
| Salmon | 0 | 0.12 | 0.12 | one fill; parking area, boat launch; state owned | north side near mile 1.8 |
| Sand Lake | no landfills; 4.1 acres of diking of which 3.0 acres is on submersible land | | | | |
| Siuslaw | 0.12 | 40.63 | 40.75 | used mainly by the city of Florence; some marine oriented with heavy emphasis on industry; 36.28 acres are dredge spoils | Florence area |
| Tillamook | 0.57 | 102.06 | 102.63 | industry oriented; no particular emphasis on navigation | Garibaldi area |
| Umpqua | 8.50 | 97.54 | 106.04 | 80 acres used for marina and harbor at Winchester Bay; remainder mainly marine oriented with heavy emphasis on deep water navigation and industry | Winchester Bay and Reedsport |
| Yaquina (below Toledo) | 55.06 | 202.06 | 257.12 | are only 3 fills over 5 acres--all marine oriented with heavy emphasis on deep water navigation and industry | Newport and Marine Science Center areas and north side of river between miles 4 and 5 |

¹submerged lands--those lying below the line of ordinary low water of all navigable waters.

²submersible lands--those lying between the line of ordinary high water and the line of ordinary low water.

(More complete definitions are given in the Inventories of Filled Lands [69].)

Fish ladders on Oregon coastal streams are constructed and operated by the OSGC, Fish Commission of Oregon (FCO), Corps of Engineers at Bonneville Dam, and the National Marine Fisheries Service in Portland, although those of the latter two agencies are located exclusively on the Columbia River. The FCO and OSGC fishways are found on tributaries of various estuaries with the OSGC owning, inspecting, and operating all of theirs [56], and the FCO possibly only inspecting ladders which are not exactly owned by them [45].

Records of constructed fishways mentioned in the individual reports were taken from a FCO publication describing the "Coastal 60-40 Program" [119]. The program, passed into law in May 1961, was administered by the FCO from July 1, 1961 to July 1, 1963 and provided mainly for fishways and stream clearance projects. A more accurate and complete list of ladders is as follows [28,56]:

| | | |
|---|---|------|
| Youngs Bay | | |
| Barth Falls--Klaskanine River | | FCO |
| Necanicum | | |
| Mail Creek Culvert--Necanicum River | | |
| City of Seaside Dam--South Fork Necanicum River | | FCO |
| Sunset Trout Farm--North Fork Necanicum River | | |
| Nehalem | | |
| Hamlet Falls--North Nehalem River | } | FCO |
| Water House Falls--North Nehalem River | | |
| Fishhawk Lake--Nehalem River | | |
| Tillamook | | |
| Fall Creek--Wilson River | } | FCO |
| Fox Creek Culvert--Wilson River | | |
| Killiam Creek--Tillamook River | | |
| Nestucca | | |
| Upton Falls--Little Nestucca River | } | FCO |
| Stella Falls--Little Nestucca River | | |
| 101 Camp Fishway--Nestucca River | | |
| " ? "--Nestucca River | | OSGC |
| Salmon River | | |
| Trout Creek Falls (Rock Cut)--Slick Rock Creek | | FCO |
| Siletz | | |
| Mill Creek Falls--Siletz River | } | FCO |
| Valsetz Falls--Siletz River | | |
| Cedar Creek Falls--Siletz River | | |
| Sunshine Creek--Siletz River | | |
| Valsetz Lake--Siletz River | | |
| Yaquina | | |
| City of Toledo Dam--Mill Creek | } | FCO |
| Sloop Creek (Rock Cut)--Yaquina River | | |
| Quarry Falls--Little Elk | | |
| Alsea | | |
| Five Rivers Fishway--Alsea River | } | FCO |
| Cascade Creek Falls--Alsea River | | |
| Fall Creek Falls--Alsea River | | |
| Henning Dam--South Fork Alsea | | |
| Bohannon Falls Upper--Drift Creek | | |
| Bohannon Falls Lower--Drift Creek | | |
| Scott Creek (Rock Cut)--Alsea River | | |
| Grant Creek 1 (Rock Cut)--Alsea River | | |
| Grant Creek 2 (Rock Cut)--Alsea River | | |

| | | |
|--|---|------|
| Siuslaw | | |
| Siuslaw Falls--Siuslaw River | | OSGC |
| Umpqua | | |
| Smith River Falls--Smith River | | FCO |
| South Umpqua Falls--South Umpqua | | |
| Winchester Dam--North Umpqua River at Winchester | } | OSGC |
| Smith River Falls--Smith River | | |
| Coos | | |
| Vaughn Falls--Millicoma River | } | |
| Tioga Creek 1--Coos River | | FCO |
| Tioga Creek 2 (Rock Cut)--Coos River | | |
| Air Force Dam--North Creek of North Slough | | |
| Coquille | | |
| Middle Creek Falls--Coquille River | } | |
| Steelhead Falls--North Fork Coquille River | | FCO |
| LaVern Park Falls--North Fork Coquille River | | |
| Rogue | | |
| Savage Rapids Dam--Rogue River | | |
| Oak St. Div. Dam--Bear Creek | | FCO |
| Bear Creek Div. Dam--Bear Creek | | |
| Frilder Dam--Rogue River | | |

The OSGC, FCO, and National Marine Fisheries Service operate hatcheries on Oregon Rivers. The National Marine Fisheries Service hatcheries, like its fishways, are on the Columbia River only; therefore, only the FCO and OSGC hatchery locations are given here. Release statistics presented here were taken from the OSGC annual report [80] and from the FCO biennial report [33]. Hatchery names and locations are as follows [54,56]:

| | | |
|---|--|------|
| Nehalem | | |
| North Nehalem River--1/4 mile downstream from highway | | FCO |
| 53 bridge | | |
| Tillamook | | |
| Trask River--5 miles east of Tillamook at the mouth | | FCO |
| of Gold Creek | | |
| Nestucca | | |
| Cedar Creek--Nestucca River | | OSGC |
| Siletz | | |
| Siletz River--North Fork Rock Creek, 4 to 5 miles | | FCO |
| east of Logsdan | | |
| Alsea | | |
| Alsea River--on Fall Creek at mile 3 or 4, 30 miles | | FCO |
| from Waldport | | |
| North Fork Alsea--out of town of Alsea | | OSGC |
| Umpqua | | |
| Rock Creek--North Umpqua River out of Idlewild Park | | OSGC |
| Coquille | | |
| Bandon--Bandon | | OSGC |
| Elk | | |
| Elk River Salmon Hatchery--11 to 12 mile NE of Port | | |
| Orford | | |
| Rogue | | |
| Butte Creek--Butte Falls | | OSGC |

Estuary Uses

Industrial and Commercial

Listed and described in this section are the types of industries which are of particular economic importance to each estuary area. Foremost among these are lumbering and commercial fishing activities and various aspects of tourism and recreation (such as sport fishing, which is described in the "Recreational" section). Most of the information was provided by the Port Commissions and Chambers of Commerce or taken from the 1972 Directory of Oregon Manufacturers [71] published by the State Economic Development Division.

In connection with the lumber industry, statistics of channel use (taken from Army Corps of Engineers records [129]) and figures for log raft storage are mentioned for many estuaries. Locations of and the area covered by log rafts at Siuslaw estuary were supplied by the Port Commission, but in the other cases, that information would have to be obtained directly from the industries having log rafts. This information should eventually be more readily available through the Division of State Lands since that agency plans to have completed an inventory of log rafts on all navigable waters in Oregon by 1974 or 1975 with eventual zoning and leasing [46].

Statistics of commercial fish landings were made available by the FCO [20,34,118] and the OSGC [75,76,77,78,79] and have generally been presented in terms of annual catch and value to fishermen. Landings given here are divided into two groups--those from the estuary alone and those taken from the entire area (ocean, estuary, streams) and received at a port on the estuary. There is actually little commercial fishing directly from the estuaries and their tributaries, especially since the Columbia River is the only place in Oregon where commercial fresh water salmon fishing is presently permitted [4,20]. However, many ports receive commercially-caught salmon taken in nearby ocean areas. Included among them during 1971 were [34]:

| | |
|-------------------------|--------------------|
| Astoria | |
| Nehalem | |
| Tillamook | North Coast Basin |
| Pacific City (Nestucca) | |
| Depoe | |
| Newport (Yaquina) | Mid-Coast Basin |
| Florence (Siuslaw) | |
| Winchester Bay (Umpqua) | Umpqua River Basin |
| Coos | |
| Bandon (Coquille) | |
| Port Orford | South Coast Basin |
| Brookings | |
| Gold Beach | Rogue River Basin |

Statistics of commercial landings received at ports on the estuaries of this report are given in Tables D and E.

Table D. Commercial harvest of food fish in pounds round weight at Oregon estuaries [34].

| Receiving port | Chinook | Coho | Green sturgeon | Shad | Striped bass | Smelt | Pinks | Crabs | Clams | Shrimp | Albacore tuna | Groundfish | Oysters | Misc. | Totals |
|-------------------------|---------|-----------|----------------|---------|--------------|----------------|-------|-----------|--------|-----------|---------------|------------|---------|-------|------------|
| Astoria | 162,631 | 788,509 | 25,886 | -- | --- | --- | 110 | 5,148,741 | 30,227 | 1,797,242 | 11,293,939 | 10,524,609 | --- | --- | 29,750,716 |
| Nehalem Bay | --- | 524 | --- | --- | --- | --- | --- | --- | 589 | --- | --- | 262 | --- | --- | 1,375 |
| Tillamook | 18,449 | 777,671 | --- | --- | --- | --- | 5 | 987,058 | 5,948 | 896,080 | 118,217 | 72,689 | 239,136 | --- | 3,115,941 |
| Netarts Bay | --- | --- | --- | --- | --- | --- | --- | 21,761 | 1,598 | --- | --- | --- | --- | --- | 23,359 |
| Sand Lake | --- | --- | --- | --- | --- | no information | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Pacific City (Nestucca) | 18,347 | 792,773 | --- | --- | --- | --- | 17 | 142 | --- | --- | 7,924 | 45,030 | --- | 148 | 864,381 |
| Salmon River | --- | --- | --- | --- | --- | no information | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Siletz | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 176 | 176 |
| Newport (Yaquina) | 104,876 | 1,695,469 | 9,599 | --- | --- | 350 | 1,848 | 3,624,105 | 2,039 | 3,601,879 | 998,262 | 2,369,197 | 39,560 | --- | 12,447,184 |
| Waldport (Alsea) | --- | --- | --- | --- | --- | --- | --- | 3,914 | --- | --- | --- | --- | --- | 6,877 | 10,791 |
| Florence (Siuslaw) | 6,898 | 133,395 | --- | 8,290 | 1,242 | 40 | --- | 134,213 | --- | --- | 12,003 | 2,293 | --- | --- | 298,374 |
| Winchester Bay (Umpqua) | 2,377 | 781,611 | 50 | 246,968 | 56,321 | 5,976 | 1,580 | 809,070 | 7,459 | 81,330 | 13,766 | 4,561,702 | --- | --- | 6,592,210 |
| Coos | 128,945 | 2,119,332 | --- | 54,973 | 8,884 | --- | 929 | 1,898,998 | 10,892 | 1,521,483 | 376,877 | 2,688,307 | 208 | --- | 8,809,929 |
| Randon (Coquille) | 48,113 | 440,728 | --- | 11,607 | 537 | --- | 1,912 | 20,328 | --- | --- | 660 | 7,037 | --- | --- | 530,922 |
| Port Orford | 77,530 | 260,046 | --- | --- | --- | --- | 1,647 | 469,500 | --- | 410,672 | 11 | 552,890 | --- | --- | 1,772,296 |
| Gold Beach | 45,052 | 185,414 | --- | --- | --- | --- | 45 | 300 | --- | --- | 953 | 5,830 | --- | --- | 237,594 |
| Brookings | 492,015 | 1,478,040 | --- | --- | --- | --- | 904 | 1,072,526 | --- | 766,320 | 240,004 | 1,178,134 | --- | --- | 5,227,943 |

1 Total miscellaneous landings consisted of 8,002 shrimp (16%), 39,537 crawfish (78%), and 3,000 eel (6%).

Table E. Estimated fishermen value of food fish landings received at Oregon estuaries, 1971 [34].

| Receiving port | Chinook | Coho | Green Sturgeon | Shad | Striped bass | Smelt | Pinks | Crabs | Clams | Shrimp | Albacore tuna | Groundfish | Oysters | Misc. 1 | Totals |
|-------------------------|-----------|-----------|----------------|----------|--------------|----------------|---------|-------------|-----------|-----------|---------------|------------|-----------|---------|-------------|
| Astoria | \$ 75,000 | \$247,000 | --- | --- | --- | --- | --- | \$1,184,000 | \$ 18,000 | \$208,000 | \$3,086,000 | \$865,000 | --- | --- | \$5,683,000 |
| Nehalem Bay | --- | --- | --- | --- | --- | no information | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Tillamook | 10,000 | 243,000 | --- | --- | --- | --- | --- | 227,000 | 1,000 | 109,000 | 37,000 | 6,000 | \$270,000 | \$1,000 | 904,000 |
| Netarts Bay | --- | --- | --- | --- | --- | --- | --- | 5,000 | --- | --- | --- | --- | --- | --- | 5,000 |
| Sand Lake | --- | --- | --- | --- | --- | no information | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Pacific City (Nestucca) | 10,000 | 248,000 | --- | --- | --- | --- | --- | --- | --- | --- | 5,000 | 4,000 | --- | --- | 265,000 |
| Salmon River | --- | --- | --- | --- | --- | no information | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Siletz | --- | --- | --- | --- | --- | no information | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Newport (Yaquina) | 63,000 | 531,000 | \$1,000 | --- | --- | --- | \$1,000 | 1,087,000 | --- | 431,000 | 302,000 | 195,000 | 81,000 | --- | 2,682,000 |
| Waldport (Alsea) | --- | --- | --- | --- | --- | --- | --- | --- | 1,000 | --- | --- | --- | --- | 7,000 | 8,000 |
| Florence (Gislaw) | 4,000 | 42,000 | --- | \$ 1,000 | --- | --- | --- | 40,000 | --- | --- | 4,000 | --- | --- | --- | 91,000 |
| Winchester Bay (Umqua) | 15,000 | 245,000 | --- | 34,000 | \$9,000 | \$2,000 | --- | 283,000 | 1,000 | 10,000 | 4,000 | 375,000 | --- | --- | 978,000 |
| Coos | 66,000 | 663,000 | --- | 8,000 | 1,000 | --- | --- | 665,000 | 1,000 | 197,000 | 112,000 | 221,000 | --- | --- | 1,934,000 |
| Randon (Comille) | 27,000 | 138,000 | --- | 2,000 | --- | --- | 1,000 | 7,000 | --- | --- | --- | 1,000 | --- | --- | 176,000 |
| Port Orford | 40,000 | 81,000 | --- | --- | --- | --- | 1,000 | 164,000 | --- | 54,000 | --- | 45,000 | --- | --- | 385,000 |
| Gold Beach | 23,000 | 58,000 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 81,000 |
| Brookings | 242,000 | 463,000 | --- | --- | --- | --- | --- | --- | 376,000 | 101,000 | 71,000 | 97,000 | --- | --- | 1,350,000 |

¹ Total miscellaneous landings consisted of 8,002 shrimp (16%), 39,537 crawfish (78%), and 3,000 eel (6%).

Recreational

The information given in this section is concerned primarily with angling activities, although parks, campgrounds, and boat landings have also been at least partially listed.

The major references were again provided by the OSGC [75,76,77,78,79] and the FCO [38]. One of these, the 1971 Estuarine Resource Use Study conducted by the FCO [38], ⁽⁵⁾ is mentioned in most of the reports and should be explained to some extent. In the study itself, the total number of landings by boat and shore angling, clamming, and scuba diving were recorded for each estuary by species between March and October 1971. Fish such as salmon and trout which are under the jurisdiction of the OSGC were excluded from the study. The information given here lists only the three species most commonly caught (in order of frequency) by boat and shore angling and by clam digging--scuba diving catches were usually omitted since they accounted for a very small percentage of the total catch.

The task of developing and operating public recreation areas at the state level is the responsibility of the Parks and Recreation Section of the Oregon State Highway Division [122], and it was from that agency that a listing of state parks located on the estuaries with a day user and camper attendance figures was obtained [67,68]. Other parks, boat landings, and national forests in each area are also mentioned in this section, although the information is far from complete.

Table of Surveillance Stations

This includes climatological, stream and crest stage gaging, water quality, water temperature, and chemical analysis stations for which references were found. Where available, the following information was included for each station: its name and/or an identifying number (usually USGS); an approximate location; the drainage area at its location; the period of record; and the reference(s) which mentioned the station.

In describing the period of record, the dates may not always be accurate since some refer to the water year and some refer to the calendar year, and the distinction was not always noted. (The water year runs from October first of one year to September 30th of the next, and it is designated by the calendar year in which it ends--records between October 1, 1954 and September 30, 1955 fall in the 1955 water year, and therefore would be considered as dating from 1955, although the records would actually date from 1954.)

In noting the period of record, an asteric (*) denotes it as being periodic while a dash (-) indicates a continuous record. In many instances, the second date given is in parentheses ().

(5) Preliminary data was presented here; publication is scheduled for March 1973.

This indicates that it is not necessarily the last date of record, but merely the last one for which records were found. Those dates not in parentheses denote the final date of record. For example, 1915*1925 would mean that records were kept periodically from 1915 to 1925; 1915-(1968) would mean that records were kept continuously from 1915 through 1968 with 1968 being the most recent record found.

Definitions

anadromous--migrating up rivers from the sea to breed in fresh water.

biochemical oxygen demand (BOD)--a measure of the oxygen necessary to satisfy the requirements of microbes for the aerobic decomposition of organic matter. The amount of oxygen consumed in the test can be used as a direct measure of biodegradable organic matter.

coliform--a group of bacteria with various habitats (e.g., soil, plants, insects, old sewage, intestines of warm-blooded animals, previously-polluted waters), the presence of which reflects the safety of water.

diurnal range--the range between the highest and lowest tides occurring during one tidal day.

diurnal tide--tides having a period or cycle of approximately one tidal day. Such tides exhibit only one high and one low water during a tidal day; the predominant type of tide in the Gulf of Mexico [69].

drainage basin--a part of the surface of the earth that is occupied by a drainage system, which consists of a surface stream or a body of impounded surface water together with all tributary surface streams and bodies of impounded surface water [139].

extreme tidal range--the range between the highest and lowest tides of the year.

fecal coliform--the type of coliform bacteria found in the intestines of warm-blooded animals, the presence of which reflects the safety of water.

fresh water yield--the fresh water contribution in a stream to an estuary.

game fish--fish of major recreational interest (e.g., salmon, bass, trout, shad).

head of high tide--the farthest point up a stream that tidal fluctuations are felt.

high water (HW)--same as high tide; the maximum height reached by each rising tide [127].

higher high water (HHW)--the higher of the two high waters of any tidal day. The single high water occurring daily during periods when the tide is diurnal is considered to be a higher high water [127].

higher low water (HLW)--the higher of two low waters of any tidal day [127].

littoral drift--the material moved in the littoral (shore) zone under the influence of waves and currents [127].

low water (LW)--same as low tide; the minimum height reached by each falling tide [127].

lower high water (LHW)--the lower of the two high waters of any tidal day [127]. 21

lower low water (LLW)--the lower of the two low waters of any tidal day. The single low water occurring daily during periods when the tide is diurnal is considered to be a lower low water [127].

mean high tide (MHT)--same as mean high water [69].

mean high water (MHW)--the average height of the high waters over a 19-year period. All high waters are included in the average where the tide is either semidiurnal or mixed. Where the type of tide is predominantly diurnal, only the higher high-water heights are included in the average on those days when the tide is semidiurnal [69].

mean higher high tide (MHHT)--same as mean higher high water [69].

mean higher high water (MHHW)--the average height of the higher high waters over a 19-year period [69].

mean low tide (MLT)--same as mean low water [69].

mean low water (MLW)--the average height of the low waters over a 19-year period. All low water heights are included in the average where the type of tide is either semidiurnal or mixed. Where the type of tide is predominantly diurnal, only the lower low water heights are included in the average on those days when the tide becomes semidiurnal [69].

mean lower low water (MLLW)--the average height of the lower low waters over a 19-year period [69].

mean sea level (MSL)--the average height of the surface of the sea for all stages of the tide over a 19-year period, usually determined from hourly height readings. A determination of mean sea level that has been adapted as a standard for heights is called a sea level datum [69].

mean tide level (MTL)--a tidal datum midway between mean high water and mean low water. Also called half-tide level [69].

mean tide range--the average range of consecutive high and low tides over a 19-year period.

mixed tides--tides in which the presence of a diurnal wave is conspicuous by a large inequality in either the high or low-water heights, or in both, with two high waters and two low waters occurring each tidal day. Tides along the California (and Oregon) Coast are of the mixed type [69].

non-game fish--those which are of no major recreational interest (e.g., suckers, shiners, sculpin).

non-salmonid game fish--warm-water game fish (e.g., bass, crappie, bluegills).

partly-mixed system--see Introduction.

parts per thousand (ppt)--a unit for expressing the concentration of chemical constituents by weight, usually as grams of constituent per thousand grams of a solution.

Pearl-Benson Index (PBI)--a measure of the lignin content of pulp wastes [136].

salinity intrusion--the farthest point at which salinity can be measured.

salmonid--a fish of the family Salmonidae, which includes salmon, trout, chars, and whitefishes.

sediment load--the quantity of sediment being transported hydraulically.

semidiurnal tides--tides having a period of approximately one-half a tidal day; the type of tide that is predominant throughout the world, with two high waters and two low waters each tidal day. Tides along the Atlantic Coast are of this type [69].

submerged lands--lands lying below the line of ordinary low water [69].

submersible lands--lands lying between the line of ordinary high water and the line of ordinary low water [69].

tidal prism--the total amount of water that flows into a harbor or estuary and out again with movement of the tide, excluding any fresh water flow [127].

tidal prism on mean range--the tidal prism between the extremes of the mean tide range.

tidelands--the land that is covered and uncovered by the daily rise and fall of the tide; the zone between the mean high-water line and the mean low-water line [69].

tidewater--same as head of high tide.

two-layered system--see Introduction.

void ratio--the ratio of the volume of voids (fluids) to the volume of solids.

well-mixed system--see Introduction.

ALSEA BAY

ALSEA BAY

General Description of Estuary and Drainage Basin

Estuary

Alsea Bay lies roughly 130 miles south of the mouth of the Columbia River. Of the estuaries included here, it ranks 7th in size (Table A). The only incorporated town in the area is Waldport, located on the south side of the bay near the mouth. This and other population centers on the estuary are given in Table 1 with their locations and 1970 populations [94,111].

Table 1. Population centers at Alsea Bay¹ [94,111]

| name | general location | river mile location | 1970 population |
|-----------------------|-------------------------|---------------------|-----------------|
| Waldport ² | Alsea River; south side | 0.7 to 2.7 | 700 |
| Bayview | Alsea River; north side | 2.2 | rural |
| Little Albany | Alsea River | 10.6 | 50 |
| Tidewater | Alsea River; north side | 11.7 | 150 |
| Little Switzerland | Alsea River; north side | 12.7 | not listed |

¹Tidal effects extend approximately to mile 16 of the Alsea River and to mile 5.5 of Drift Creek.

²Incorporated

The estuary measures 7,500 feet at its widest point [60] and covers about 2,170 acres. Surface areas reported by Johnson [55], Marriage [59], and the Division of State Lands [70] are given in Table 2, and cross-sectional areas at MTL at various distances from the mouth are shown in Table 3.

Table 2. Reported surface areas of Alsea Bay [55,59,70].

| reference | surface area (acres) | measured at | tidelands | | submerged lands | |
|-----------|-------------------------|--------------|-----------|---------|-----------------|---------|
| | | | acres | percent | acres | percent |
| [6] | 2,140 | HW | | | | |
| [63] | 2,227 | ¹ | | | | |
| [117] | 2,146 | MHT | 979 | 46 | 1,168 | 54 |
| | 1,168 | MLT | | | | |

¹Specified by Marriage as the area affected by tidal action.

Alsea Bay

Table 3. Cross-sectional areas of Alsea Bay [43].

| point of measurement | distance from mouth (miles) ¹ | cross-sectional area (sq ft) |
|----------------------|---|---------------------------------|
| throat | 0 | 8,000 |
| Waldport | 1.9 | 15,000 |
| Oakland | 5.7 | 4,600 |
| Kozy Kove | 11.7 | 2,100 |

¹Mile values were obtained by conversion from the distances reported in feet.

The estuary consists essentially of the lower reaches of the Alsea River, which is charted as having its zero mile at the mouth of Alsea Bay. The river drains an area of 474 sq mi and is formed at mile 48.7 by the North Fork Alsea River (total length 15.0 miles) and the South Fork Alsea River (total length 17.4 miles). Tributaries to head of high tide at mile 16 include Drift Creek from the north at mile 5.1 and about 21 smaller creeks and sloughs. Drift Creek measures 29.2 miles to its source and has a drainage area of 69 sq mi [88,94].

A good deal of information on Alsea Bay was presented in a 1971 dissertation by A.L. Matson entitled "Zooplankton and Hydrography of Alsea Bay, Oregon, September 1966 to September 1968" [60], and the work is referred to frequently in this chapter.

The Port of Alsea is located at Waldport, and can be contacted at P.O. Box 638, Waldport, Oregon 97394; 563-3564 [106].

Drainage Basin

Alsea Bay has a drainage basin of 474 sq mi [94] which yields an average of 1,500,000 ac-ft of fresh water annually (estimate based on data collected from 1937 to 1963) [88]. A large part of the rugged and mountainous basin is within the Siuslaw National Forest [49]. It consists of 94% (446 sq mi) forests; 3% (14 sq mi) cropland and 3% (14 sq mi) ranges and "other uses" [88].

Precipitation averages 80 to 90 inches annually, with 60 inches per year occurring along the coast and 110 inches per year in the upper watershed. There is a climatological station located on the Alsea River near mile 11.5 from which precipitation records are available through the OSWRB (Table 10) [19,88,92,143]. Elevations range from 0 to 3,000 feet [88].

Alsea Bay

Hydraulic Description of Estuary

Tides and Currents

The bay is described as being fully exposed to waves at the throat [55]. The head of high tide is at mile 16 of the Alsea River and mile 5.5 of Drift Creek [43].

The mean tidal range is 5.8 feet with a diurnal range of 7.7 feet [55]. Goodwin reported a tidal prism on mean range of 5×10^8 cu ft (tidal prism between MLLW and MHHW), and he noted a "choking" of tidal range occurring from the entrance of the estuary to the Oakland Marina Station (5.7 miles from the mouth) [43]. Beyond the marina station, amplification of the tidal range occurred. Goodwin also looked at the phase difference between tidal elevations and tidal currents and found it to be equal to 90 to 100 degrees. A calibrated numerical tidal hydraulic model of the Alsea has been provided by Goodwin [42]. Currents and tidal ranges have been measured (1973) to determine the times of maximum ebb and flood flow [62].

River Discharges

Stream flow records are available from USGS stream gaging stations on the Alsea River and Drift Creek (Table 10) [140]. The Alsea River station is located at river mile 21.0. The one on Drift Creek, no longer operating as of 1970, was located at mile 21.8, where the drainage area is 20.5 sq mi or 27% of the stream's total drainage basin. Streamflow averages and extremes for these two stations are given in Table 4 [140]. The combined average flow rate of the Alsea River and Drift Creek is estimated as 2,070 cfs [86].

Table 4. Flow rates of Alsea Bay tributaries [140].

| stream | point of measurement (river mile) | drainage area (sq mi) | complete water years of record | flow rate (cfs) | | |
|-------------|--------------------------------------|--------------------------|--|--------------------|-------------|-------|
| | | | | maximum | minimum | mean |
| Alsea River | 21.0 | 334 | 1939-1970 | 41,800 12/64 | 45 9/65 | 1,534 |
| Drift Creek | 21.8 | 20.5 | 1957-1963 1966-1970 (discontinued) | 2,500 10/62 | 3.8 9/58 | 120 |

Salinity and Classification by Mixing

Matson measured salinity intrusion to mile 13.8 of the Alsea River [60]. This was in August 1967 at high tide when stream flow was 63 cfs. Measurements by Burt and McAllister in October 1957 and January, March, July 1958 showed intrusion to mile 13.0 (October 8, 1957 at HHW) at a concentration of 0.1 ppt on the surface and at the bottom [12]. Concurrent temperatures were 12.9°C. No salinity was detected at mile 13.7.

Alsea Bay

On the basis of mixing characteristics, Burt and McAllister [13] and Matson [60] have described the estuary as a partly-mixed system. Burt and McAllister collected data at high tide during January, March, April and October; Matson collected data at all tidal stages from September 1966 to September 1968. During that two-year period, Matson also looked at four sites in the estuary (the mouth, 5,000 feet, 2.3 miles, and 4.6+ miles) for long-term layering of waters of different densities and found that the site at mile 4.6+ was the only one where such layering might occur.

Giger [39] provides salinities with depth and length for high and low tides during winter (1968), spring (1968), and summer (1967) conditions. This data show salinity intrusion during the summer to a distance of 13-14 miles from the mouth while winter salinity intrusion extended to 4-5 miles from the mouth. Vertical stratification appears to occur to some degree during all seasons.

Seasonal (1973) measurements of salinity, temperature, turbidity, pH and dissolved oxygen have been taken for high and low tides with depth and length within the estuary [62].

Sediments

Littoral drift in the area varies throughout the year but tends to be northward in the winter and southward in the summer with the net drift to the south [57]. Sediments deposited in the estuary by its tributaries are estimated at 249,000 tons annually [85].

Water Quality Information

The DEQ operates six water surveillance stations at Alsea Bay (listed in Table 10) for which records of measurements taken 5 times between July 1969 and December 1971 are available [67, 68]. There is also a USGS water temperature station at mile 21 of the Alsea River (Table 10) [139]. Temperature ranges recorded at this point and at two sites in the Alsea River monitored by Matson [60] are presented in Table 5.

Table 5. Temperature extremes of the Alsea River [60,139].

| point of measurement | period of record | observed temperature extremes (°C) | |
|----------------------|--------------------------------------|------------------------------------|---------|
| | | maximum | minimum |
| mouth | 9/66-9/68 | 16 | 7 |
| | | surface | |
| mile 5 | 9/66-9/68 | 22 | 4 |
| | | surface | |
| mile 12 | 1947-1962 (110 spot observations) | 25.6 | 0.6 |

Alsea Bay

The city of Waldport operates the only sewage treatment plant in the Alsea Bay area. It is located on the east side of town in the "old town" section and serves the Waldport population only. Average daily flow is estimated at 90,000 gallons. Presently a primary treatment facility, it will be secondary on completion of the new addition now in progress [21].

Biological Information

Estimates of the number of adult anadromous Salmonids spawning in the Alsea River system are as follows: spring chinook--300, fall chinook--20,000, coho--58,000, winter steelhead--13,600, summer steelhead--200, and sea-run cutthroat--28,600 [75]. A comparison with other stream systems of the Mid-Coast Basin (Table B) shows that the Alsea River system has the highest estimated numbers of fall chinook, coho, and winter steelhead spawning in its waters.

Species supported in the estuary which are of interest to fishermen include salmon, staghorn sculpin, flounder, perch, crab, shrimp, and cockle, gaper, and softshell clams. The softshells are found primarily two miles upstream from Waldport and are more abundant than the cockle and gaper clams [38,53,155].

In Matson's study conducted from September 1966 to September 1968, he looked at zooplankton in the estuary and found the following species accounting for the greatest percentage of the total number: Acartia clausi (found mainly in the center of the estuary)--40%; Barnacle Nauplii (equally distributed upstream and downstream)--11%; and Pseudocalanus sp (found more downstream)--8.1% [60].

The area around the estuary is considered a big game winter range primarily for black-tailed deer (the most abundant big game), Roosevelt elk (now being transplanted to the Mid Coast Basin by the OSGC), black bear, and cougar [75].

Lint Slough, which discharges into the Alsea River from the south at mile 1.8, is used as an OSGC experimental station for rearing salmon under saline conditions [155].

Physical Alterations

Jetties have not been constructed, but a basin project providing for a protective breakwater, an entrance channel, and a small boat basin at Waldport has been approved [129]. A date for beginning the project had not been given as of 1971 (publication date). A portion of the present channel, located along the south side of the estuary, was excavated in 1948 and met a previously-existing south channel, which ran between the highway 101 bridge and the entrance of Drift Creek, at some point

Alsea Bay

upstream. This channel system measures 1,400 feet at its widest point. A northern channel in the estuary was blocked off in three places sometime before June 1962. The channel to the ocean shifts (the controlling depth is about 6 to 7 feet), limiting navigation [60]. Navigable length of the Alsea River is 13.0 miles; that of Drift Creek is 1.5 miles [69].

The inventory of filled lands in the Alsea River has been completed by the Division of State Lands [69]. Table C shows some of the information from that report.

Under the "Coastal 60-40 Program" the FCO constructed three fishways in the Alsea River system--one on Five Rivers and two on Drift Creek. The Five Rivers Fishway, located 1 mile above the town of Paris (or approximately at mile 18), was completed in 1963. The Drift Creek Fishways were completed in 1964 and are located about 15 miles south of Toledo. In 1963 a spawning channel on Cherry Creek, about one mile below the town of Fisher, was also constructed under the program [119].

There are two hatcheries in the Alsea River system--one operated by the FCO and the other by the OSGC. The FCO Alsea River Salmon Hatchery is between miles 3 and 4 of Fall Creek, or approximately 35 miles from the estuary mouth [54]. Releases from it between July 1, 1968 and June 3, 1969 were to Fall Creek and tributaries of the Coos and Coquille Rivers and consisted of 3,006,149 salmon and steelhead [33]. The OSGC hatchery, located on the North Fork Alsea River near the town of Alsea and a little over 50 miles from the estuary mouth [56], released 900,555 winter steelhead in 1968. During 1970, its releases totaled 1,942,636 and consisted of 967,809 winter steelhead, 678,738 fall chinook, and 296,089 cutthroat trout [80].

Estuary Uses

Industrial and Commercial

Lumber-related activities, tourism, and agriculture are of major economic importance to the area [69,153,155]. Most manufacturers there, listed in Table 6, are involved with logging activities [71,153]. Industrial use of the bay itself is limited to log towing [155]; it is not used for log raft storage, and there are no industries actually on it [102].

Commercial fishing, from the estuary or otherwise, provides a very limited income as indicated by the commercial harvest figures shown in Tables 7 and 8.

Alsea Bay

Table 6. Major Manufacturers at Alsea Bay [71].

| Location | Name | Type of Business | Number employed |
|-----------|--------------------------|---------------------------|-----------------|
| Waldport | M and W Lumber Co. | logging | 60 |
| Waldport | Alsea Veneer | veneer core | 20 |
| Waldport | W.H. Meinert Co. | cutting contractor | 5 |
| Waldport | McKinley Lumber Co. | railroad spike-hole plugs | 3 |
| Waldport | M.R. Kittel Logging | logging | 1 |
| Waldport | Waldport Ready Mix | ready mix | |
| Tidewater | Gerald Smallwood Logging | logging | 4 |
| Tidewater | Julian F. Smallwood | logging | 4 |
| Alsea | Tidewater Crushing Co. | crushed rock | 6 |

Table 7. Commercial Harvest of Clams, Crabs, and Bait Shrimp from Alsea Bay [75,118].

| Species | 1969 | | 1970 pounds landed | 1971 pounds landed |
|-------------|------------------|--|--------------------------|--------------------------|
| | pounds landed | fishermen value | | |
| Clams | 16 | prices vary according to species and market | | |
| Crabs | 21,000 | \$5,250 | 3,249 | 3,316 |
| Bait Shrimp | 5,500 | 7,220 (retail) | | |

Alsea Bay

Recreational

The main recreational activities in the area are fishing, boating, agate hunting, clamming, and crabbing [153]. Angling data shown in Table 9 indicate that salmon fishing from the estuary is especially popular. In fact, more time and money are spent on this sport there than at any other Mid-Coast Basin estuary [75]. The best time for chinook trolling is during August and September, and the coho run begins in mid September and peaks in October [58]. Sea-run cutthroat can be taken from July to November [58]. Species other than salmon and trout most commonly caught during the FCO study from March to October 1971 include staghorn sculpin, starry flounder, and shiner perch by shore angling; dungeness crab and relatively few staghorn sculpin and redbait seaperch by boat angling, and ghost shrimp, cockle and softshell clams by clamming [38].

Alsea Bay

Table 8. Commercial Harvest of Food Fish Received at Waldport 1971⁽¹⁾ [34].

| Species | Harvest (pounds round weight) | Fishermen value |
|------------------------------|----------------------------------|--------------------|
| Crabs | 3,914 | \$1,000 |
| Miscellaneous ⁽²⁾ | 6,877 | 7,000 |
| Totals | 10,791 | \$8,000 |

¹Includes 1971 data presented in Table 7.

²Sand shrimp, crawfish, eel

Table 9. Estimated Annual Harvest Data for Sport Fishing At Alsea Bay⁽¹⁾ [75].

| Species | area fished | annual harvest (total number) | effort (angler-days) | gross expenditures |
|--------------------------|----------------|----------------------------------|-------------------------|-----------------------|
| Salmon | Estuary | 6,900 | 27,600 | \$510,600 |
| | Alsea River | 1,730 | 6,920 | 128,020 |
| Sea-run cutthroat | Estuary | 4,550 | 10,500 | 194,250 |
| | Alsea River | 650 | | |
| Steelhead | Alsea River | 6,000 | 24,000 | 444,000 |
| Non-salmonid bay fish | Estuary | 15,000 | 5,000 | 30,000 |

¹Average of data from past years.

Alsea Bay

Table 10. Surveillance Stations at Alsea Bay.

| type of station | name and/or identifying number | approximate location | drainage area (sq.mi) | period of record | references |
|------------------------|--|---|-----------------------|--------------------------------------|--------------------------|
| climatological | Tidewater | Alsea River; mile 11.5 | 58 | 1940-(1968) | [88,92,143] ¹ |
| stream gaging | Alsea River near Tidewater; USGS #3065 | Alsea River; mile 21 | 334 | 1939-(1970) | [88,98,140] ² |
| | Drift Creek near Salado; USGS #3066 | Drift Creek; mile 21.8 | 20.5 | 1958-1963 1965-1970 | [140] |
| crest stage gaging | South Fork Weist Creek near Waldport | South Fork Weist Creek; mile 1 (about 6 miles from the estuary mouth) | 0.33 | 1953-(1963) | [88] |
| DEQ water surveillance | #1 | Highway 101 bridge at Waldport (mile 0.9) | | 7/69-(12/71) (5 measurements) | [67,68] |
| | #2 | channel at mouth of Lint Slough (mile 1.8) | | " | " |
| | #3 | channel 50 yards below the mid-channel island (mile 2.9) | | " | " |
| | #4 | channel opposite boat docks at Chevron gas outlet (mile 3.9) | | " | " |
| | #5 | Alsea River at high tension wire crossing (mile 4.9) | | " | " |
| | #6 | Alsea River; 1.25 miles above Highway 34 bridge (mile 9.7) | | " | " |
| water quality | Alsea River near Tidewater; USGS #3065 | Alsea River; mile 21 | 334 | 1958-1959 (spot observations) | [88] |
| water quality | Drift Creek above Tidewater | | | 1958-1959 (spot observations) | [88] |
| water temperature | Alsea River near Tidewater; USGS #3065 | | 334 | 1947-1962 (110 spot observations) | [88,139] |

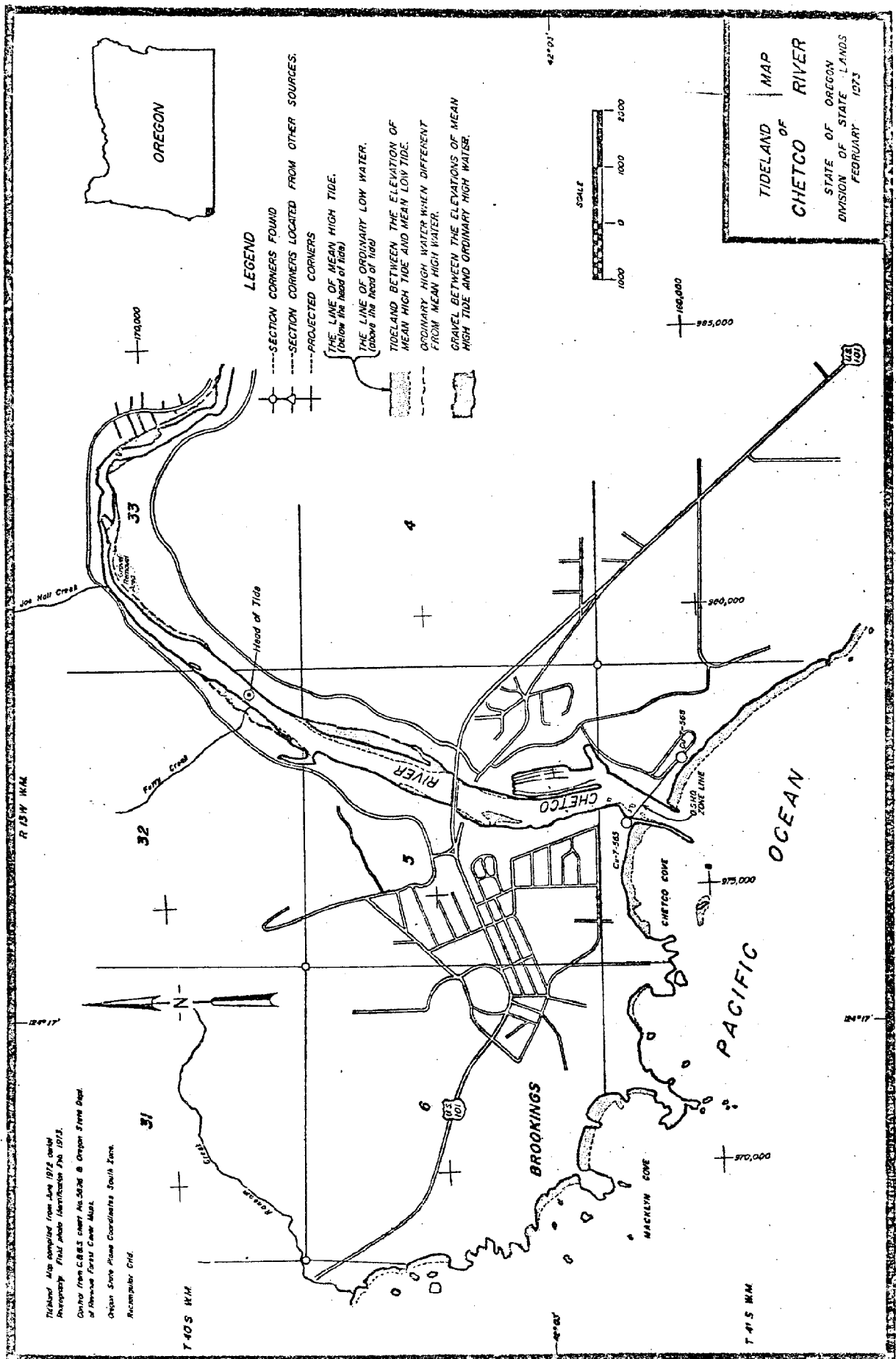
¹ Precipitation data available in punch card or printout form through the OSWRB.

² Monthly and water-year runoff records have been compiled and are available in punch card or printout form through the OSWRB.

³ Data available in punch card or printout form through the DEQ.

() This is the most recent record date found and is not necessarily the last.

CHETCO BAY



CHETCO BAY

General Description of Estuary and Drainage Basin

Estuary

The Chetco River discharges into the Pacific Ocean at a point 300 miles south of the Columbia River mouth. The estuary is the smallest of those included here (Table A), and the area around it is sparsely populated. The only two towns near the Chetco River are Brookings and Harbor, both at the mouth. Brookings lies to the north between miles 0 and 1.1. It was incorporated in 1951 and had a 1970 population of 2,720. Harbor, with a 1970 population of 900, lies on the south side of the estuary at mile 0.7 [96,111].

The HW surface area of the estuary, is estimated from the 1954 USGS Cape Ferrelo Quad., is 140 acres [55].

The estuary consists primarily of the lower reaches of the Chetco River, which has a length of 58.0 mi. and drains an area of 359 sq. mi. [96]. One of the larger tributaries to the estuary is the North Fork at mile 5.4 with a length of only about 14 miles and drainage area 40 sq. mi.

The port commission for the area is Port of Brookings, P.O. Box 848, Brookings, Oregon, 97415; telephone number 469-2219 [106]. The Port Commission and Curry County Planning Commission have jurisdiction over planning and regulating land use [81].

Drainage Basin

The 359 sq. mi. drainage basin is comprised mainly of forests, although some of the area around the estuary is used for pasture and hay, rangelands can be found slightly upstream [93]. Much of the inland portion of the basin is within the Siskiyou National Forest. Annual fresh water yield of the Chetco River at its mouth was estimated to average 1,230,000 ac-ft during the period from 1930 to 1961, although there were no complete water years of record. Extremes of the annual average were 1,570,000 ac-ft and 740,000 ac-ft [93].

Annual rainfall in the basin averages from 80 inches along the coast to 120 inches near the headwaters of the Chetco River. Growing season in the basin lasts about 250 days. Monthly precipitation at Brookings, where the elevation is 80 feet, averages from less than an inch (July and August) to almost 13 inches (December and January). The climatological station at Brookings (Table 7) has records dating back to 1912 which are available on punch cards.

Elevations of the Chetco Basin watershed range from sea level to 5,098 feet at Pearsoll Peak in the western region [93]. Average wind direction in the vicinity of the estuary during the period from 1937 to 1942 was as follows: November, December, January, February, and March--northeast; April, May, and June--northwest; July and August--south; September--northwest; and October--north [7].

The Chetco River stream profile appears on page 43.

CHETCO BAY

Hydraulic Description of Estuary

Tides and Currents

The estuary is described as being partially--exposed to waves at the throat. The mean tide range is 5.1 feet with a diurnal range of 6.9 feet [55].

River Discharges

The only stream gaging station in the basin for which records were found is located at mile 10.7 of the Chetco River. Also, there are crest stage gaging stations on Harris and Ransom Creeks near Brookings (both streams discharge directly into the ocean just to the north of the estuary.) More descriptions of these three stations are given in Table 7, and discharge records are included in Table 1. Also shown in Table 1 is information concerning minimum miscellaneous discharge measurements taken periodically since 1926 in the Chetco River below the mouth of the North Fork at mile 5.4. Estimates of the average monthly discharge of the Chetco River at the mouth for 1930 to 1961 have been presented in "South Coast Basin," [93]. These show the high average flow rate occurring in February (4,000 cfs) and the low in September (130 cfs) with a twelve-month mean of 1,700 cfs.

Salinity and Classification by Mixing

No information.

Sediments

Net littoral drift in the area is from north to south [57].

Results of analyses of two dredge samples taken from the Chetco River by the Corps of Engineers in July 1971 showed organic contents ranging from 1.83% to 4.04%, void ratios from 0.577 to 0.769, and mean grain size medium to fine sand [124].

Water Quality Information

At the present time, the DEQ has no water surveillance stations on the Chetco River.

Thermograph records taken at mile 4.4 of the Chetco River on August and September of 1962 (Table 7) show a mean water temperature in August of 66°F and extremes of 73°F and 62°F and September with a mean temperature of 63°F and extremes of 69°F and 58°F [138].

As of 1963, the only sewage treatment plant in the area was a primary facility serving a population of 3,000 and capable of serving 5,000 [93].

CHETCO BAY

Table 1. Flow rates of the Chetco River and nearby coastal tributaries [93,140].

| Stream | Point of measurement | Drainage area (sq.mi.) | Period of record | Flow rate (cfs) | |
|---|-------------------------------|------------------------|------------------|---------------------|----------------------|
| | | | | maximum | minimum |
| Chetco River (near Brookings) | mile 10.7 | 271 | 10/69-(1971) | 65,800 (1/16/71) | 52 (10/14,15,/70) |
| Chetco River ⁽¹⁾ | below mouth of the North Fork | | 1926*1952 | --- | 47.70 (9/31) |
| Ransom Creek ^(2,3) (near Brookings) | | | 1953-1961 | 300 (1/53) | --- |
| Harris Creek ^(2,3) (near Brookings) | | | 1953-1961 | 439 (12/54) | |

(1) Minimum miscellaneous discharge measurements only.

(2) Annual maximum discharge measured at crest stage gaging stations.

(3) Ransom and Harris Creeks are coastal streams located just north of the Chetco R.

() This is the most recent record date found and is not necessarily the last.

* Period of record is not continuous.

Biological Information

Estimated number of adult anadromous salmonids spawning in the Chetco River are as follows: spring chinook--0; fall chinook--3,000; coho--500; steelhead--4,000; and sea-run cutthroat--2,500 [78]. In comparison with other estuarine stream systems included here (Table B), these numbers are quite low.

Roosevelt elk are present in the watershed, but are not as numerous as in the northern section of the South Coast Basin. According to the preliminary report [70] to "Environmental Investigations. South Coast Basin," [78], the only significant wildlife area in the lower bay is a section where brown pelican feed on anchovies during the summer. Eel grass is not present in the estuary. Following is a check list of fishes, waterfowl, birds, and mammals found in the vicinity of Chetco Bay [81].

CHETCO BAY

Biological Information

Game fish found in the estuary at least during a part of the calendar year (in order of abundance) are: cutthroat trout, winter steelhead, fall chinook, coho, rainbow trout. Game birds found are: American widgeon, green-winged teal, pintail, scaup, ring-necked duck, bufflehead, common golden eye, and red-breasted merganser.

Shore and other birds most commonly found in or near Chetco Bay are: least sandpiper, western sandpiper, western gull, herring gull, California gull, belted kingfisher, double-crested cormorant, and brown pelican.

Medium common mammals found in or near Chetco Bay are: harbor seal, river otter, and the beaver. Uncommon mammals found are: California sea lion, stellers sea lion, mink and black-tailed deer.

Physical Alterations

Modifications to Chetco Bay, summarized in Table 2, were completed in 1957 with further alterations between 1965 and 1970. Studies to determine the feasibility of extending the jetties have been authorized, but funds have not yet been made available as of 1971 [129].

Water borne traffic through the channel project totaled 191,000 tons in 1969, consisting almost entirely of wood chips. Annual use between 1960 and 1969 averaged 99,000 tons [129].

Table 2. U.S. Army Corps of Engineers modifications to Chetco Bay [126,129].

| Proposed modification | Location | Demensions | | | Date and stations ⁽¹⁾ |
|---------------------------------|-------------------------|---|--------------|--------|---|
| | | Depth (feet) | Width (feet) | Length | |
| North Jetty | | | | | 1957-Completed 1965-Authorized 1970-Completed |
| | | Elevation increased; length extended 450 ft. | | | |
| South Jetty | | | | | 1957-Completed 1962-Repairs completed |
| Entrance channel | through the bar | 7 14 | 120 120 | | 1965-Authorized 1970-Completed |
| Small boat basin and barge ship | down stream from Harbor | 4 | | | |
| Protective dike | | | | 1,800 | 1965-Authorized 1970-Completed |
| Small boat access channel | | 12 | 110 | | 1965-Authorized 1970-Completed |

(1) Lack of completion date does not necessarily signify that the modification has not been completed.

CHETCO BAY

Estuary Use

Industrial and Commercial

Economy of the basin depends primarily on forestry and the manufacture of wood products, Table 3. Wood products are shipped from the estuary, and use is made of adjacent lands for stockpiling of wood chips. Agriculture, commercial fishing, and recreation are also of importance. Mining does not make a considerable contribution, although there are several claims in the area. Most of the known mineral deposits, located in the headwaters of the Chetco River, are either chromite or gold [34,81].

Table 3. Major manufacturers at Chetco Bay [71].

| Location | Name | Type of Business | Number Employed |
|-----------|--|------------------|-----------------|
| Brookings | Brookings Plywood Corp. | (2432) | 340 |
| " | South Coast Lumber Co. | (2421) | 165 |
| " | Agnew Timber Co. | (2432) | 100 |
| " | Ferry Creek Rock and Concrete Inc. | (3273) | 15 |
| " | Pacific Rock and Paving | (2951) | 15 |
| " | Wood Logging Eugene S. | (2411) | 15 |
| | 21 manufacturers employing 10 or less dealing in (2411). | | |
| Harbor | Brookings Fiberglass Boat Inc. | (3732) | 9 |
| " | Kirkpatrick, DR | (2411) | 1 |
| " | Driftwood House | (2999) | |

() Type of business is given in [71]: "Directory of Oregon Manufacturers, 1972 " Each manufacturer is listed under the number in parentheses.

CHETCO BAY

Estuary Use

Industrial and Commercial

Commercial food fish landings received at Brookings are shown in Table 4 and again in Tables D and E of the introduction. In comparison with landings received at other Oregon Ports, these figures are fairly high. Twenty-two percent of the 1970 commercial salmon catch of the South Coast Basin was received at Bandon. Total catch for the basin (South Coast) consisted of 3,000,000 pounds of coho and 1,200,000 pounds of chinook at a value to fishermen of \$2,500,000 [34,78].

Due to frequent flooding and drainage problems, agricultural use of the tidal areas consists primarily of dairying activities rather than hay and pasture. About 270 acres of the well-drained sandy soils south of Brookings are used for lily bulb production. Although the area used is relatively small, the activity is of considerable economic importance [93].

Table 4. Commercial harvest of food fish received at Brookings, 1971 [34].

| Species | Harvest (pounds round weight) | Fisherman value |
|------------------|-------------------------------------|--------------------|
| Coho | 1,478,040 | \$ 463,000 |
| Groundfish | 1,178,134 | 97,000 |
| Crabs | 1,072,526 | 376,000 |
| Shrimp | 766,320 | 101,000 |
| Albacore tuna | 240,004 | 71,000 |
| Pinks | 904 | --- |
| TOTALS | 5,227,934 | \$1,350,000 |

Recreational

Sport fishing at Chetco Bay is becoming increasingly popular. The Chetco River provides the best salmon and steelhead fishing south of the Rogue River. Chinook enter the river from September to mid-November. Coho are present from late in September through December. Casting from the up-river shores is most popular, although there is some trolling in the tidewater. Chinook fishing offshore generally begins in July; August and September are reportedly the best months for offshore coho fishing. Boats can be chartered at Brookings [58,81]. According to the FCO study from October to March 1971, there was a limited silver and striped perch fishery by shore anglers in the estuary. Boat angling for anchovy proved more successful [38]. Estimated salmon and trout annual harvest data for the area are given in Table 5 [78].

CHETCO BAY

Estuary Uses

Recreational

Table 5. Estimated annual harvest data for recreational fishing at Chetco Bay(1) [78]

| Species | Area fished | Annual Harvest (total number) | Effort (anglerdays) | Gross Expenditures |
|-------------------|---------------------|----------------------------------|------------------------|--------------------|
| Salmon | ocean | 8,000 | 16,800 | \$592,000 |
| | estuary | 1,400 | 3,500 | 103,000 |
| | Chetco River system | 100 | 400 | 7,400 |
| Steelhead | Chetco River system | 1,200 | 4,800 | 88,800 |
| Sea-run Cutthroat | Chetco River system | 150 | 100 | 1,850 |

(1) Average of data from past years.

Boating is also an important recreational activity and is directly associated with sport fishing [93]. The Chetco River boat landing is located at mile 0.2 [96]. In addition to fishing, hunting for black-tailed deer, elk, black bear, and waterfowl are also major recreational activities, but not in the immediate vicinity of the estuary.

State parks in the area number three. Two of these, Harris and Azalea Beaches, are located on the coast to the north. Camping is permitted at the former but not at the latter. The third park (Loeb) is situated at mile 5 of the Chetco River. Camping is also permitted there. Attendance figures for 1966, 1968, and 1970 are given in Table 6 [82].

CHETCO BAY

Table 6. State park annual attendance, 1966, 1968, and 1970 [82,83].

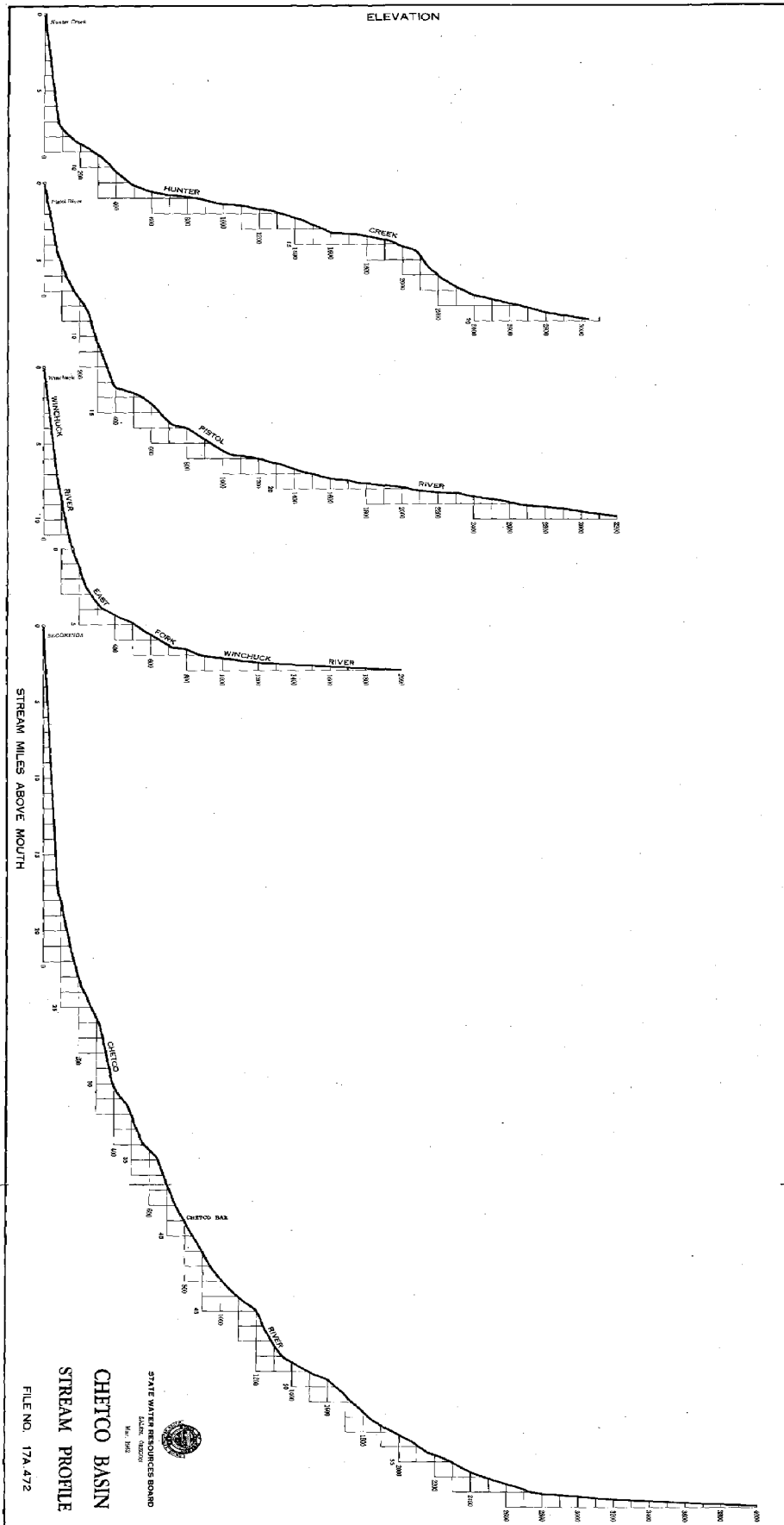
| Park | 1966 | 1968 | 1970 |
|---------------|---------|---------|---------|
| Azalea | | | |
| day visitors | 84,836 | 72,116 | 190,568 |
| Harris Beach | | | |
| day visitors | 545,128 | 542,732 | 704,734 |
| Camper nights | 61,601 | 55,273 | 56,193 |
| Loeb | | | |
| day visitors | 75,104 | 78,024 | 86,946 |
| camper nights | 7,930 | 10,801 | 13,544 |

Table 7. Surveillance stations at Chetco Bay.

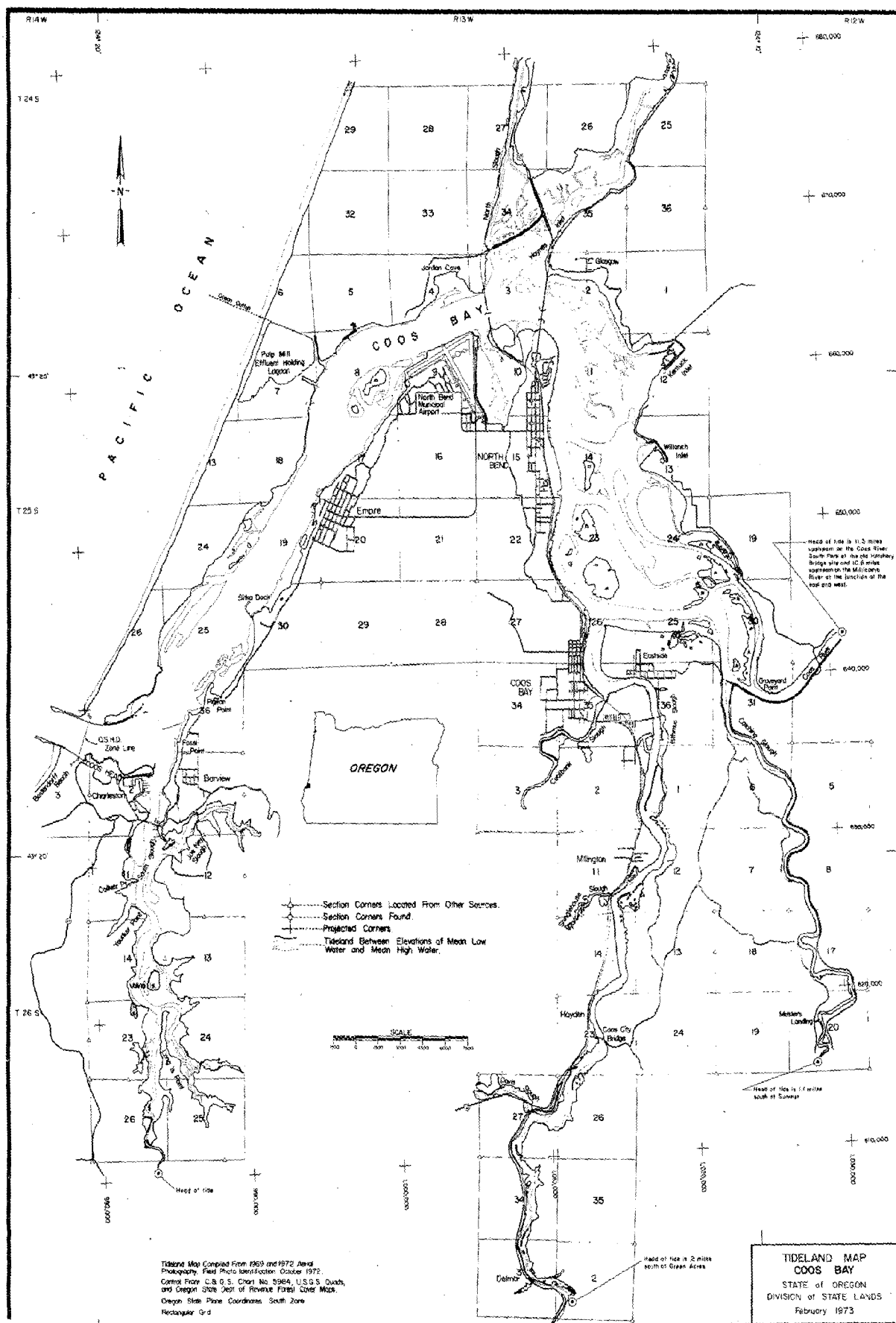
| Type of station | Name and/ or identifying number | Approximate location | Drainage area (sq.mi.) | Period of record | Reference |
|--------------------|--|-------------------------|------------------------|---------------------------|------------------------|
| Climatological | Brookings (formerly Harbor); USWB#1055 | elevation-- | | 1912-(1960) | [92,93] ⁽¹⁾ |
| Stream gaging | Chetco River near Brookings | Chetco River; mile 10.7 | 271 | 10/69-(1971) | [140] |
| Crest stage gaging | Harris Creek near Brookings USGS#3788 | | 1.05 | 1953-(1961) | [93] |
| | Ransom Creek near Brookings USGS#3789 | | 0.74 | 1053-(1961) | [93] |
| Water temerature | Chetco River near Brookings | Chetco River; mile 4.4 | | August and September 1962 | [138] |

(1) Data available in punch card or printout form through the OSWRB.

() This is the most recent record date found and is not necessarily the last.



COOS BAY



COOS BAY

General Description of Estuary and Drainage Basin

Estuary

Coos Bay, the largest of the estuaries included in this report (Table A), is located about 200 miles south of the mouth of the Columbia River. Most towns in its vicinity lie to the south. Their populations and very approximate locations are given in Table 1.

Table 1. Population centers at Coos Bay¹ [24,96,111].

| name | general location | river mile location | approximate distance from estuary mouth (miles) | 1970 population |
|-------------------------|---|----------------------------|---|-----------------|
| Barview | Coos Bay; south side | -- | 1.4 | 1,388 |
| Empire ³ | Coos Bay; south side | -- | 4.5 | 3,781 (1960) |
| Glasgow | Coos Bay; north side | -- | 9.0 | 400 |
| North Bend ² | Coos Bay; south side | -- | 9.9 | 8,553 |
| Cooston | Coos Bay; north side | -- | 10.5 | 100 |
| Coos Bay ² | Coos Bay; south side | -- | 13.3 | 13,400 |
| Eastside ² | Coos Bay; south side | -- | 15.4 | 1,331 |
| Charleston | South Slough; east side | 0 | 2 | 700 |
| Hauser | North Slough; west side | 4.5 | 13.5 | 250 |
| Englewood | Coalbank Slough; west side | 1.5 | 14.5 | |
| Libby | Coalbank Slough | 2.0 (0.6 mile to the west) | 15.0 | 300 |
| Bunker Hill | Isthmus Slough; west side | 0 | 13 | 1,549 |
| Millington | Isthmus Slough; west side | 2 | 15 | 300 |
| Dellwood | South Fork Coos River; north side | 9.0 | 26.5 | rural |
| Allegany | West Fork Millicoma River ⁴ ; north side | 0.1 | 26.3 | 40 |

¹Tidal effects extend approximately to mile 9 of the South Fork Coos River and to mile 8.7 of the Millicoma River.

²Incorporated

³Consolidated with Coos Bay in 1965

⁴Also described as being located on the Millicoma River [93,129].

Coos Bay

The estuary is roughly 10,000 acres in size; surface areas reported by Johnson [55] and Marriage [59] are presented in Table 2 with the latter's estimate of the number of tideland acres. Aerial photographs

Table 2. Reported surface areas of Coos Bay [55,59].

| reference | surface area (acres) | measured at | tidelands | |
|-----------|-------------------------|--------------|-----------|---------|
| | | | acres | percent |
| [6] | 10,973 | HW | | |
| | 8,242 | MSL | | |
| | 5,810 | LW | | |
| [63] | 9,543 | ¹ | 4,569 | 48 |

¹Specified by Marriage as the area affected by tidal action.

indicate that these tidelands consist of sand bars in the lower reaches and mainly mud, silt, and marsh-pasture flats in the upper reaches [53]. Other measurements given by Johnson are shown in Table 3 [55].

Table 3. Dimensions of Coos Bay [55].

distance from throat to
farthest estuary shore--13.4 miles

inlet dimensions at throat (at MSL):
width--2,060 feet
average depth--29 feet
cross-sectional area--56,500 sq ft

average lagoon depth below MSL--5 feet

The bay is quite complex with close to 30 tributaries, the major one being the Coos River from the east. The river's point of discharge into the bay 12 miles from the estuary mouth is considered its zero mile. It is formed by the South Fork Coos River and the Millicoma River at mile 5.5; the Millicoma River is formed by the East Fork Millicoma River and the West Fork Millicoma River at mile 8.7. Lengths, drainage areas, and annual fresh water yields of these rivers are shown in Table 4 [93,96].

Coos Bay

Table 4. Lengths, drainage areas, and fresh water yields of Coos Bay tributaries [93,96].

| Stream | Length (miles) | Drainage area ⁵ (sq.mi.) | Fresh water annual yield ¹ (ac-ft) | | |
|---------------------------|-------------------|---|--|-----------|-----------|
| | | | maximum | minimum | mean |
| Coos River | 5.5 ² | 415 | 2,200,000 | 1,130,000 | 1,590,000 |
| South Fork Coos River | 31.3 ³ | 254 | 1,280,000 | 660,000 | 930,000 |
| Millicoma River | 8.7 ⁴ | 151 | 880,000 | 450,000 | 630,000 |
| East Fork Millicoma River | 23.9 | 79 | 460,000 | 230,000 | 330,000 |
| West Fork Millicoma River | 34.9 | 55 | --- | --- | --- |

¹Yields were estimated for 1930 to 1961 by correlations from available records (consisting of spot observations with no complete water years of record).

²To the confluence of the South Fork Coos River and Millicoma River

³To the confluence of Williams River and Tioga Creek

⁴To the confluence of the West Fork Millicoma River and the East Fork Millicoma River

⁵Total Coos Bay drainage area is not the sum of these individual drainage areas.

The area port commission is stationed at the city of Coos Bay where there is also a community industrial development corporation. Their addresses and phone numbers are as follows:

Port of Coos Bay
P.O. Box 787
Coos Bay, Oregon 97420
269-1131

Jobs and Industries, Inc.
of Southwestern Oregon
P.O. Box 359
Coos Bay, Oregon 97420
267-7035

Also, located in Charleston is the University of Oregon Institute of Marine Biology (Paul P. Rudy, Director), from which a great deal of information is available.

A comprehensive report on Coos Bay has been prepared by the U.S. Department of the Interior [142].

Drainage Basin

Coos Bay drains a total of about 605 sq mi (estimated from [93-plate 1]) which yields an average of 2,200,000 ac-ft of fresh water annually [93]. The basin consists primarily of forests (88% or 532 sq mi) with some croplands (2% or 12 sq mi) and rangelands (1% or 6 sq mi) [93]. (These areas are approximate since the percentages were given for the Coos Bay drainage basin plus an adjacent coastal zone of about 124 sq mi).

Coos Bay

Average annual precipitation ranges from 50 inches along the coast to 100 inches near the headwaters of the Millicoma River [93]. Records from the North Bend and Allegany climatological stations, listed in Table 12, are available through the OSWRB in punch card or printout form [92,143].

Wind roses from North Bend show 50% of the January winds coming from the southeast at speeds generally between 4 and 15 mph and July winds coming from the north 30% of the time and from the northwest 30% of the time at speeds from 4 to 31 mph [7].

Stream profiles for the Coos Bay river systems appear on page 63

Hydraulic Description of Estuary

Tides and Currents

Coos Bay is described as being fully exposed to waves at the throat [55]. Tidal effects extend as far as Dellwood on the South Fork Coos River (mile 9) and as far as Allegany on the Millicoma River (mile 8.7) [93,96]. Both towns are about 27 miles from the estuary mouth.

The mean tidal range is 5.2 feet with a diurnal range of 7.0 feet and an extreme range of 11.0 feet [86]. Tidal prism on mean range is 1.86×10^9 cu ft with a diurnal range of 2.51×10^9 cu ft [55].

The average tidal current velocity is 2.0 knots (3.4 ft/sec) with maximum ebb currents of up to 7 knots (11.8 ft/sec) and maximum flood currents of up to 3.5 knots (5.9 ft/sec) [7].

Currents and tidal ranges are being measured (summer 1973 through spring 1974) to determine the times of maximum ebb and flood flow [1].

River Discharges

Although stream gaging stations on the estuary tributaries are limited (there is one on the West Fork Millicoma River near Allegany [140]), estimates of the average monthly discharge of the Coos, South Fork Coos, and Millicoma Rivers have been made [93]. These are shown in Table 5.

Records from September 1954 to October 1970 from the stream gaging station on the West Fork Millicoma River at mile 6.8 (Table 12) where the drainage area is 46.5 sq mi show an average discharge at this point

Coos Bay

of 257 cfs and extremes of 8,100 cfs (December 11, 1960) and 1.8 cfs (September 1965 and 1967) [140].

Salinity and Classification by Mixing

Salinity measurements in Coos Bay and the Coos River have been reported by Burt and McAllister for one date during each of the following months: June 1956, October 1957, and January, March, and June

Table 5. Flow rates of Coos Bay tributaries [93].

| stream (at mouth) | drainage area (sq mi) | average monthly flow (cfs) ¹ | | |
|-----------------------|--------------------------|---|----------------------------|-------|
| | | high | low | mean |
| Coos River | 415 | 5,500 February | 90 August September | 2,200 |
| South Fork Coos River | 254 | 3,300 February | 50 August, September | 1,300 |
| Millicoma River | 151 | 2,200 February | 30 September | 870 |

¹Yields were estimated for the period from 1930 to 1961 by correlations from available records (consisting of spot observations with no complete water years of record).

1958 [12]. Of these five test dates, salinity intrusion was greatest on June 27, 1956 at LHW at the "Coos River High School." (The distance was not given, but it is greater than 17 miles from the ocean.) Salinity was 2.3 ppt on the surface and 3.3 ppt at a depth of 13 feet with a concurrent temperature at both points of 20.9°C. Measurements beyond this were not recorded.

On the basis of salinity change from top to bottom, Burt and McAllister found that the estuary was either well mixed or partly mixed during January, April, and June; during November it was partly mixed; during all other months it was well mixed [13].

Temperature, salinity and current measurements extending over one or more tidal cycles were made by McAlister and Blanton [61] at various times during the three year period 1960-1963. On the basis of these measurements, they concluded that Coos Bay ranges from a well-mixed estuary during periods of low runoff to a partially mixed estuary during periods of maximum runoff.

Coos Bay

Burt and Queen [10] describe tidal overmixing in Coos Bay. During the flood stage of the tide, more dense water tends to flow over less dense water resulting in sinking of surface waters and thus an intense mixing over the water depth toward the end of the flood tide.

Sediments

Seasonal (summer 1973 through Spring of 1979) measurements of salinity, temperature, turbidity, pH and dissolved oxygen are being taken for high and low tides with depth and length within the estuary [1].

Littoral drift is to the south in the summer and to the north in the winter with a net transport to the south [7,57]. Since the completion of the south jetty (described under "Physical Alterations"), entrapment of sand has occurred between this jetty and Yoakim Point located approximately 1 mile to its south [57].

Sediments transported to the estuary from its drainage basin average 72,000 tons annually [85,86].

The Corps of Engineers has analyzed dredge samples which were taken from the estuary once in March 1960 and 12 times between June 1970 and May 1972 [124]. Organic contents of these samples ranged from 0.38% (April 1972--lower Jarvis Range) to 8.77% (October 1971--river mile 14.00); void ratios ranged from 0.570 (December 1970--Upper Jarvis Range) to 3.344 (March 1960--Coos Bay channel, station 51.35); and the mean grain size was generally that of fine sand. Volatile solids greater than ten percent have been reported in the Isthmus slough area [5,142]. Free sulfides have also been measured within some of the sediments of Isthmus slough [5].

Water Quality

The DEQ operates 26 water surveillance stations in this area (Table 12)--15 in the bay and 11 in South Slough [67,68]. Records in punch card or printout form are available from some stations for as far back as May 1957. The total number of sampling dates ranges from five (at a station on South Slough, operating since July 1970) to 70 (at two different stations on Coos Bay, operating since May 1957).

The primary factors affecting the water quality are commercial and domestic waste [155] and ground water seepage from a coal field (the largest in the state) located southeast of the bay and covering 250 sq mi [53]. The only area of the estuary which is reportedly still considered a definite water quality problem is Isthmus Slough [100].

Table 6. Sewage treatment plants at Coos Bay [B,65,117].

| | USN station | Coos Bay #2 | North Bend | Coos Bay #1 | Eastside | Bunker Hill | USAF station |
|--------------------|-------------|--------------------------|-------------------------------------|--|----------|-------------------|--------------|
| location | | 3/4 mile south of Empire | 1/4 mile west of North Bend Airport | 1 mile north of the center of the city of Coos Bay | | | |
| area served | | | North Bend | city of Coos Bay | | | |
| number now serving | 90 | 4,925 | 6,600 ¹ | 8,370 | 1,500 | 1,200 | |
| description | secondary | primary | primary | primary | primary | primary | secondary |
| average flow (mgd) | | 0.58 to 0.8 | 1.74 | 2.86 (3.4-peak) | 0.14 | 0.20 ¹ | |
| rainy | | | | 1.35 | 0.07 | 0.12 ¹ | |
| dry | | 0.21 | 0.59 | | | | |

¹Estimated, based on limited data [117].

Coos Bay

A listing of the major waste discharges in the Coos Basin (including receiving water, type of waste, volume, and present treatment) has been given in an interim report on a feasibility study for regionalization of sewerage facilities in the Coos River and Chetco River Basins [117]. According to this study, there are seven sewage treatment plants in the Coos Bay area. Information concerning these facilities is presented in Table 6.

Biological

The numbers of adult anadromous salmonids spawning in the Coos Bay stream system, low in comparison with the other estuarine stream systems included in this report as shown in Table B, are estimated as follows: spring chinook--0, fall chinook--500, coho--8,300, steelhead--5,000, and sea-run cutthroat 3,500 [78].

Sportsmen take salmon, striped bass, shad, perch, staghorn sculpin, crabs, and clams in the bay. The most numerous clams are gaper, which account for 40% of the state's total bay clam landings. These, along with cockle, butter, and littlenecks, are located mainly in the lower reaches of the estuary. Softshell clams (decreasing in number in recent years) are supported in the upper portions of the bay. Pacific oysters are produced in South Slough, but native oysters, which were once common, no longer exist [38,53,155].

Mallard, pintail, widgeon, and coot are the most abundant waterfowl in the Coos Bay area [78]. Canvasback and pintail ducks use it as a migrant or wintering area, and black brant use it for wintering [155].

The vicinity around the estuary is a winter range for black-tailed deer, the most numerous big game animal of the South Coast Basin. Elk winter to the east of the estuary, and the watershed contains one of Oregon's largest Roosevelt elk herds [78].

Physical Alterations

Proposed alterations to the estuary, many of which have been completed, are quite extensive with two jetties, numerous channels, and five basins. An attempt has been made to summarize these modifications, as described in the Army Corps of Engineers report [129], in Table 7. Project use statistics are included under "Estuary Uses".

Army Corps of Engineers records from 1959 through 1969 (excluding 1968) show annual dredging of the entrance channel and periodic dredging

Coos Bay

Table 7. U.S. Army Corps of Engineers Modifications to Coos Bay [128,129].

| Proposed Modification | Location. | Dimensions | | | (1) |
|-----------------------------------|--|--------------|--------------|---------------------|---|
| | | depth (feet) | width (feet) | length | |
| COOS BAY PROJECT | | | | | |
| North Jetty | entrance | | | | 1929-completed 1940-reconstructed |
| South Jetty | entrance | | | | 1970-repair started 1942-reconstructed |
| Channel | entrance | 40 | suitable | 1 mi | 1962-63-rehabilitated 1952-completed |
| Channel | entrance to mouth of Isthmus Slough (15 miles from estuary mouth) | 30 | 300 | 15 mi | 1937-"main channel" dredged to a depth of 24 feet 1951-"30-foot channel" completed |
| Channel (Isthmus Slough) | Mouth of Isthmus Slough to Millington (on Isthmus Slough; 18 miles from estuary mouth) | 22 | 150 | 3 mi | |
| Turning Basin | Opposite Coalbank Slough | 30 | 600 | 1,000 ft | |
| Turning Basin | At the City of North Bend | 30 | 600 | 1,000 ft | |
| Anchorage Basin | Outer part of-mile 3.5 | 30 | 600 | 2,000 | |
| Anchorage Basin | Coos Bay - near mile 7 | 30 | 600 | 2,000 | |
| Connecting Channel | Deep Water in Coos Bay to the Mooring Basin at Charleston (near South Slough) | 10 | 150 | | 1956-completed |
| Channel Extension | In South Slough to the Highway Bridge | 10 | 150 | | 1970-completed |
| Mooring Basin | Locality of Charleston | | 500 | 900 | 1956- "Small Boat Basin at Charleston" completed |
| Breakwater | Locality of Charleston | | | | |
| Bulkhead | Locality of Charleston | | | | |
| COOS AND MILLICOMA RIVERS PROJECT | | | | | |
| Channel | Coos River Mouth on Coos Bay to Allegany on The Millicoma River | 5 | 50 | 13.8 ⁽³⁾ | 1966-channel improvements completed |
| Channel | To Dellwood on the South Fork Coos River | 5 | 50 | 15 ⁽³⁾ | |
| Channel | Dellwood to mile 14.7 of the South Fork Coos River | 3 | 50 | 0.7 | |

¹Lack of Completion date does not necessarily signify that the modification has not been constructed (The Coos Bay project is described as complete).

²Observed on USCGS chart #5984 (March 18, 1972).

³Includes the 5.5 miles of channel on the Coos River which the 2 presumably have in common.

Coos Bay

of the "river channel" (1969), the "inner channel" (1959, 1962, 1963), and the "30-foot channel" (1961). Amounts dredged ranged from 523,752 cu yds removed from the entrance and river channels in 1969 to 2,729,077 cu yds taken from the entrance channel in 1966 [55].

Dredging (by bucket or clamshell) has been performed by private contractors in Coos and Millicoma Rivers with spoil disposal on high land [50]. In June 1972 the Georgia Pacific Co. (Coos Bay) submitted a request for a permit to do maintenance dredging in 3 areas of Isthmus Slough [31].

During the period of 1920-1970, approximately 1500 acres of tidelands have been filled and 2000 acres diked for agricultural use adjacent to Coos Bay [142]. A map of filled and diked areas is available [142].

Industrial and Commercial

Timber and fish resources are of major economic importance to the area, although agricultural activities involved mainly with dairy products, poultry, cattle, hogs, sheep and lambs, rabbits, and turkeys also provide some income [24,93,100,155].

A listing of manufacturers at Coos Bay, presented in Table 8, indicates that most jobs there are connected in some way with the lumber manufacturing industry [71]. Such jobs, in fact, account for 58% of the Coos County work force [24]. Wood and wood products comprise a large percentage of the traffic using the Coos Bay and River and Millicoma River projects [129], and Coos Bay is the leading lumbershipping port in the U.S. [4]. In 1969 the Coos Bay channel project saw 6,102,000 tons of waterborne traffic--41% (2,500,000 tons) of this was rafted logs; 36% (2,200,000 tons) was wood chips and the remaining 23% (nearly 1,500,000 tons) was lumber, exported logs, petroleum products, and paper and paperboard. Traffic using the project between 1960 and 1969 averaged 4,181,000 tons annually. Traffic on the Coos and Millicoma Rivers averaged 1,589,000 tons for the same time period and totaled 1,257,000 tons (all rafted logs) in 1969 [129]. An estimated 500 acres of the bay and its tributaries are used at some time for log rafts [100]. It has been estimated (1971) that as much as 15 to 20 percent of the surface of Marshfield Channel, Isthmus Slough, and lower Coos River are covered with stored logs [142]. A review and discussion of the ecological impacts of man's activities is provided in a special report by the U.S. Department of the Interior [142]. Lumber shipments from Port of Coos Bay in 1971 totalled 463,976,968 tons lumber and logs, 2,238,136 tons chips, 42,529 tons plywood, and 5,208,092 tons general cargo.

Coos Bay

Table 8. Major Manufacturers at Coos Bay [71,100].

| Location | Name | Type of Business | Number employed |
|------------|---|---|-----------------|
| Charleston | Peterson Sea Foods Inc. | crab and shrimp packaging | 140 |
| | Hallmark Fisheries | crab and shrimp packaging | 100 |
| | Fishermens Cooperative Association Inc. | fish, crab, and shrimp packaging | 5 |
| North Bend | Weyerhaeuser Co. | lumber and wood products (particleboard, wood chips, plywood) | 1,640 |
| | Menasha Paper Co. | corrugating paperboard | 160 |
| | Maze Bros. Logging Co. | logging and mill | 40 |
| | 17 manufacturers employing under 25 | dealing mainly in logging, wood products and soft drinks | |
| Coos Bay | Coos Head Timber Co. | saw and planing mills, plywood | 400 |
| | Georgia-Pacific Corp. | plywood | 368 |
| | Cape Arago Lumber Co. | wood products | 175 |
| | Al Peirce Co. | lumber | 115 |
| | Georgia-Pacific Corp. | hardboard | 105 |
| | Eureka Fisheries, Inc. | fishery products packaging | 69 |
| | The World | newspaper | 60 |
| | Sixes River Logging Co. | logging | 50 |
| | Georgia-Pacific Corp. | phenolic and urea resins, formaldehyde, chemical specialties | 45 |
| | 35 manufacturers employing 35 or under | dealing mainly in lumber and wood products | |
| Eastside | Nelson Log Bronc Co. | steel work boats and tugs; steel fab-saw mill equipment | 19 |

Coos Bay

Commercial fishing from Coos Bay itself, as indicated by the statistics presented in Table 9 is quite limited [20,118]. However, landings received

Table 9. Commercial Harvest of Shad, Striped Bass, Crabs, and Clams at Coos Bay, 1969, 1970, and 1971 [20,118].

| Species | 1969 | | 1970 | | 1971 | |
|-----------------------------|---------------|-----------------|---------------|-----------------|---------------|-----------------|
| | pounds landed | fishermen value | pounds landed | fishermen value | pounds landed | fishermen value |
| Shad ⁽¹⁾ | 32,425 | \$4,000 | 59,865 | \$9,000 | 54,973 | \$8,000 |
| Striped Bass ⁽¹⁾ | 18,337 | 3,000 | 13,524 | 2,000 | 8,984 | 1,000 |
| Crabs ⁽²⁾ | | | 67,846 | | 24,339 | 1,000 |
| Clams ⁽²⁾ | 5,109 | | 4,522 | | 10,893 | |

¹Source of reference [20]; data for Coos Bay and its tributaries.

²Source of reference [118]; data for Coos Bay.

there from the entire area (Table 10) are extensive [34]. In 1971 Coos Bay was one of the Oregon ports receiving the most commercial fish landings (Tables D and E), and in 1970 it received 57% of the South Coast Basin salmon landings [34,78]. Most of the fish packaging plants there (Table 8) are centered in Charleston [71].

A report covering the ecological features of Coos Bay has been prepared by the U.S. Department of the Interior. The report includes maps of Coos Bay showing aquatic vegetation, benthic shellfish habitat, bristle worm species, and shrimp habitat [142].

Recreational

As can be seen from Table 11, sportsmen spend a great deal of time and money on angling at Coos Bay. Salmon fishing is excellent offshore, where chinook and coho abound from early June to early September. A limited number of fall chinook and coho can also be caught near the head of tidewater from mid September to the beginning of November [58,78]. Most commonly caught species other than salmon and trout, as determined by the FCO Study from March to October 1971, include shiner perch, staghorn sculpin, and red rock crab by shore angling; dungeness crab and relatively few black rock fish and red rock crab by boat angling; and gaper, butter, and cockle clams by clamming [38]. The estuary also

Coos Bay

reportedly provides good shad fishing, particularly in June and July, as well as some of the best striped bass fishing of the South Coast Basin with July to October being the peak period. Striped bass from the bay average 6 pounds [78].

Table 10. Commercial Harvest of Food Fish Received at Coos Bay, 1971⁽¹⁾ [34].

| Species | Harvest (pounds round weight) | Fishermen value |
|---------------|----------------------------------|--------------------|
| Groundfish | 2,688,307 | \$ 221,000 |
| Coho | 2,119,332 | 663,000 |
| Crabs | 1,898,998 | 665,000 |
| Shrimp | 1,521,483 | 197,000 |
| Albacore Tuna | 376,877 | 112,000 |
| Chinook | 128,945 | 66,000 |
| Shad | 54,973 | 8,000 |
| Clams | 10,893 | 1,000 |
| Striped Bass | 8,984 | 1,000 |
| Pinks | 929 | — |
| Oysters | 208 | — |
| Totals | 8,809,929 | \$1,934,000 |

¹Includes 1971 data presented in Table 9.

Table 11. Estimated Annual Harvest Data for Sport Fishing at Coos Bay (1) [78].

| Species | area fished | annual harvest (total number) | effort (angler-days) | gross expenditures |
|----------------------|------------------|----------------------------------|-------------------------|------------------------|
| Salmon | Estuary Ocean | 500 28,400 | 1,250 32,300 | \$ 37,000 2,101,600 |
| Sea-run cutthroat | Streams | 150 | 100 | 1,850 |
| Steelhead | Streams | 1,400 | 5,600 | 103,600 |
| Shad | Estuary | 6,500 | 2,990 | 55,315 |
| Striped bass | Estuary | 875 | 1,660 | 30,710 |

¹Average of data from past years.

Coos Bay

Table 12. Surveillance stations at Coos Bay.

| type of station | name and/or identifying number | approximate location | drainage area (sq mi) | period of record | references |
|------------------------|---|--|-----------------------|----------------------------------|--------------------------|
| climatological | Charleston | elevation--10 feet | | 1938-1940 | [93] |
| | North Bend FAAAP (formerly Marshfield) USGS #6073 | elevation--11 feet | | 1902-1960 | [92,93,143] ¹ |
| | Allegany | Millicoma River; mile 9 | | 1940-1960 | [92,93,143] ¹ |
| stream gaging | West Fork Millicoma River near Allegany; USGS #3245 | West Fork Millicoma River; mile 6.8 | 46.5 | 1954-(1970) | [98,140] ² |
| DEQ water surveillance | #1 | Coos Bay; green light #7; 1/4 mile north of Fossil Point | | 5/57-(5/72) (43 measurements) | [67,68] ³ |
| | #2 | Coos Bay; red light #10; 1/4 mile north of Pigeon Point | | 5/57-(5/72) (70 measurements) | " |
| | #3 | Coos Bay; red light #12; 1/2 mile north of Sitka Dock | | 5/57-(5/72) (42 measurements) | " |
| | #4 | Coos Bay; red light #16; 1/4 mile north of Empire Dock | | 4/60-(5/72) (38 measurements) | " |
| | #5 | Coos Bay; green light #23 opposite Henderson Marsh | | 5/57-(5/72) (70 measurements) | " |
| | #6 | Coos Bay; black can #27; 1/4 mile west of railroad bridge | | 5/57-(5/72) (41 measurements) | " |
| | #7 | Coos Bay; green light #35; mouth of Kentuck Slough | | 5/57-(5/72) (70 measurements) | " |
| | #8 | Coos Bay; red light #36; opposite mouth Cooston-Willanch Channel | | 5/57-(5/72) (42 measurements) | " |
| | #9 | Coos Bay Yacht Club; opposite McCurdy Marina | | 5/57-(5/72) (42 measurements) | " |
| | #10 | Coos Bay; shipping channel opposite mouth of Marshfield Channel | | 5/57-(5/72) (42 measurements) | " |

Coos Bay

Table 12. Surveillance stations at Coos Bay, cont.

| type of station | name and/or identifying number | approximate location | drainage area (sq mi) | period of record | references |
|------------------------|--------------------------------|---|-----------------------|----------------------------------|----------------------|
| DEQ water surveillance | #11 | Coos Bay; red light 1 mile up Marshfield Channel | | 8/57-(5/72) (25 measurements) | [67,68] ³ |
| | #12 | Coos Bay; green light #43 opposite downstream from Coalbank Slough | | 5/57-(5/72) (25 measurements) | " |
| | #13 | Coalbank Slough at Highway 101 bridge | | 9/66-(5/72) (12 measurements) | " |
| | #14 | Isthmus Slough at Eastside Bridge | | 5/57-(5/72) (25 measurements) | " |
| | #15 | Isthmus Slough at Coos City Bridge | | 6/60-(5/72) (21 measurements) | " |
| | #1 | South Slough; 150 yards east of flashing light at entrance; opposite fisherman's coop | | 4/67-(5/72) (19 measurements) | " |
| | #2 | South Slough; 15 yards east of southern most moorage float at Charleston small boat basin | | 4/67-(5/72) (20 measurements) | " |
| | #3 | South Slough; 100 yards west of slip on east bank | | 4/67-(5/72) (19 measurements) | " |
| | #4 | South Slough; channel 50 yards east of Hallmark Fisheries Dock, Charleston | | 4/67-(5/72) (20 measurements) | " |
| | #5 | South Slough; channel, 20 yards west of Hansen's Landing Docks | | 4/67-(5/72) (20 measurements) | " |
| | #6 | South Slough; channel, 50 yards west of mouth of Joe Ney Slough | | 4/67-(5/72) (19 measurements) | " |
| | #7 | South Slough; channel, 250 yards south of Colliver Point | | 4/67-(5/72) (19 measurements) | " |
| | #8 | South Slough; channel, 0.3 miles southwest of station 7, 50 yards west of bank | | 4/67-(5/72) (13 measurements) | " |

Coos Bay

Table 12. Surveillance stations at Coos Bay, cont.

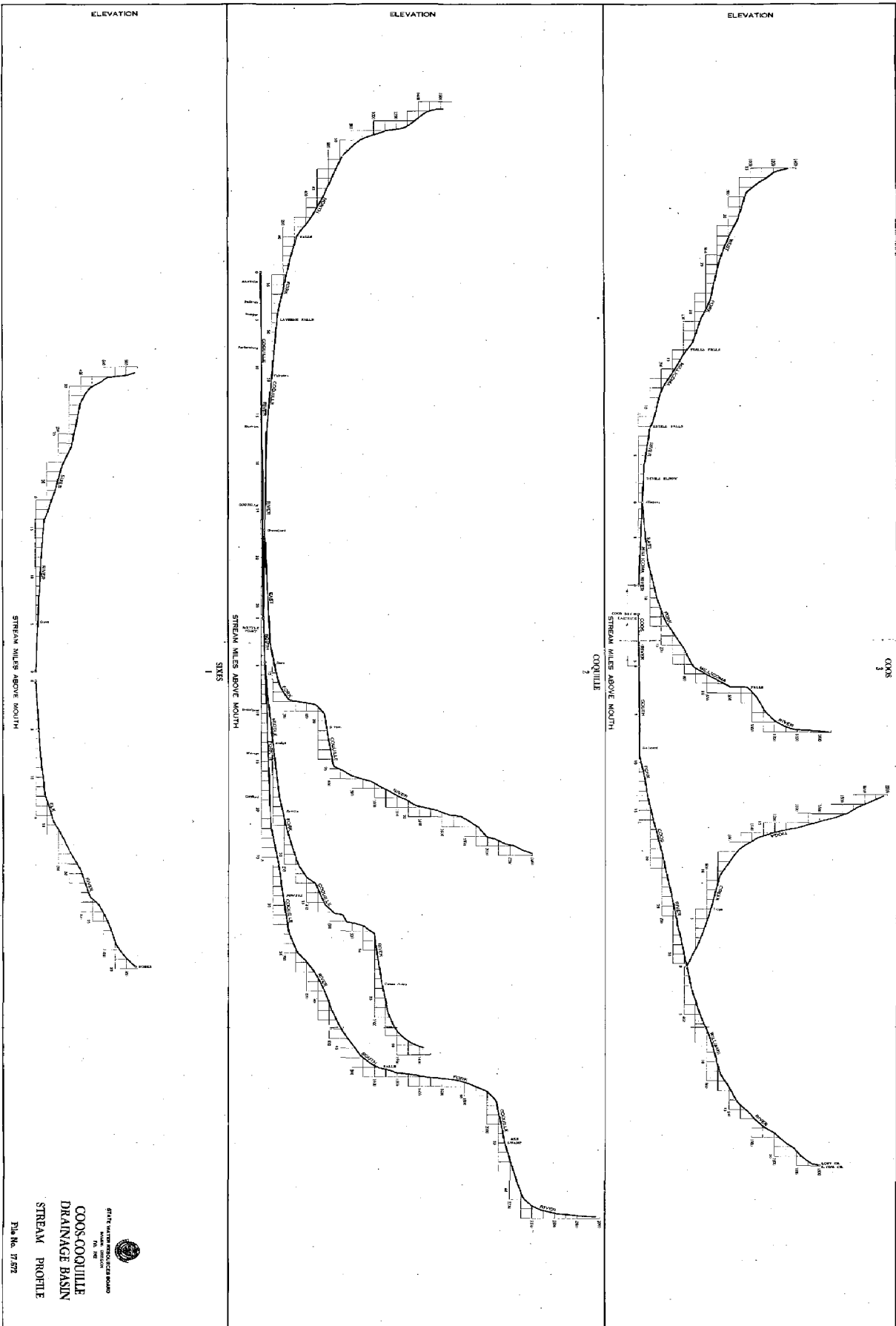
| type of station | name and/or identifying number | approximate location | drainage area (sq mi) | period of record | references |
|------------------------|---|--|-----------------------|-------------------------------|----------------------|
| DEQ water surveillance | #9 | South Slough; channel, 0.3 mile south of station 8 | | 4/67-10/68 (12 measurements) | [67,68] ³ |
| | #10 | South Slough; channel, 0.2 mile south of station 9 | | 4/67-10/68 (12 measurements) | " |
| | #11 | South Slough; Joe Ney Road bridge | | 7/70-5/72 (5 measurements) | " |
| water quality | | Coos River; miles 1.8, 4, and 5.5 | | 1930-1933 (spot observations) | [93] |
| water temperature | West Fork Millicoma River near Allegany | West Fork Millicoma River; mile 6.8 | 46.5 | 10/54-(1968) (4 days monthly) | [141] |
| chemical analysis | " | " | " | 10/63-(9/68) | [141] |

¹Precipitation data available in punch card or printout form through the OSWRB.

²Monthly and water-year runoff records have been compiled and are available in punch card or printout form through the OSWRB.

³Data available in punch card or printout form through the DEQ; records are not complete before 1967.

() This is the most recent record date found and not necessarily the last.




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 DRAINAGE BASIN
 STREAM PROFILE
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COQUILLE BAY

COQUILLE BAY

General Description of Estuary and Drainage Basin

Estuary

Coquille Bay lies approximately 225 miles south of the mouth of the Columbia River. It is a long and narrow estuary and is among the smallest of those included in this report (Table A). Population in the area is centered in the incorporated towns of Bandon, Coquille, and Myrtle Point. Approximate locations and 1970 populations of these and other towns have been summarized in Table 1 [96,111].

Table 1. Population centers at Coquille Bay¹ [96,111].

| name | general location | river mile location | approximate distance from estuary mouth (miles) | 1970 population |
|---------------------------|--------------------------------------|------------------------------|---|-----------------|
| Bandon ² | Coquille River; south side | 0.1 to 1.8 | 0.1 to 1.8 | 1,832 |
| Prosper | Coquille River; south side | 4.5 | 4.5 | rural |
| Randolph | Coquille River; north side | 6 | 6 | rural |
| Parkersburg | Coquille River; south side | 8.0 | 8.0 | rural |
| Riverton | Coquille River; south side | 16.4 | 16.4 | 150 |
| Leneve | Coquille River; north side | 19.5 (0.5 mile to the north) | | |
| Coquille ³ | Coquille River; north side | 24.5 to 24.9 | 24.5 to 24.9 | 4,437 |
| Johnson | Coquille River; east side | 27.7 | 27.7 | no pop |
| Arago | Coquille River; west side | 32.5 | 32.5 | 100 |
| Norway | Coquille River; north side | 34.7 | 34.7 | 150 |
| Myrtle Point ² | South Fork Coquille River; east side | 0.7 to 1.7 | 37 to 38 | 2,511 |

¹Tidal effects extend approximately to between miles 36 and 40 of the Coquille River.

²Incorporated

³Incorporated in 1970

The estuary measures roughly 760 acres (an average of the surface area given by Johnson at HW [55] and by Marriage [59] and presented in Table 2). Other dimensions reported by Johnson are given in Table 3 [55].

Coquille Bay

Table 2. Reported surface areas of Coquille Bay [55,59].

| reference | surface area (acres) | measured at |
|-----------|-------------------------|--------------|
| [6] | 818 | HW |
| | 582 | MSL |
| | 346 | LW |
| [63] | 703 | ¹ |

¹Specified by Marriage as the area affected by tidal action.

Table 3. Dimensions of Coquille Bay [55].

distance from throat to
farthest estuary shore--2.3 miles

inlet dimensions at throat (at MSL):
width--620 feet
average depth--11.5 feet
cross-sectional area--7,030 sq ft

average lagoon depth below MSL--7feet

The major tributary of Coquille Bay is the Coquille River which has its zero river mile at the mouth of the estuary, at the outer end of the jetties [96]. The main stem of the Coquille River is formed by the South Fork Coquille River and the North Fork Coquille River at a point 36.3 miles from its mouth. Tributaries (creeks and sloughs) of this main stem number about 13 from the north and 20 from the south. The entire Coquille River, from its mouth to the headwaters of the South Fork Coquille River, measures 99 miles, making it the longest river of the South Coast Basin [93]. The Middle Fork Coquille River flows into the South Fork Coquille River at mile 4.7, and the East Fork Coquille River discharges into the North Fork Coquille River at mile 9.1. Tables 4 and 5 give the lengths, drainage areas, and estimated fresh water yields of these major streams [93,96].

Coquille Bay

Table 4. Lengths and drainage areas of Coquille Bay tributaries [96].

| stream | length (miles) | drainage area (sq mi) |
|----------------------------|-------------------|--------------------------|
| Coquille River | 36.3 ¹ | 1,058 |
| North Fork Coquille River | 53.3 | 289 |
| South Fork Coquille River | 62.8 | 598 |
| East Fork Coquille River | 33.8 | 135 |
| Middle Fork Coquille River | 40.3 | 310 |

¹To the confluence of the North Fork Coquille and South Fork Coquille Rivers

Table 5. Fresh water yields of Coquille Bay tributaries [93].

| stream | point of measurement | drainage area (sq mi) | complete water years of record | fresh water annual yield ¹ (ac-ft) | | |
|-------------------------------|--------------------------|-----------------------------|--------------------------------------|--|-----------|-----------|
| | | | | maximum | minimum | mean |
| Coquille River | mouth | 1,058 | none | 3,900,000 | 1,220,000 | 2,400,000 |
| North Fork Coquille River | near Myrtle Point | 276 | 1930-1946 | 1,120,000 | 374,000 | 720,000 |
| South Fork Coquille River | Powers (near mile 29) | 169 | 1917-1926; 1930-1961 | 950,600 | 287,000 | 573,000 |
| East Fork Coquille River | mouth | 135 | none | 450,000 | 150,000 | 290,000 |
| Middle Fork Coquille River | near Myrtle Point | 305 | 1931-1946 | 1,020,000 | 257,000 | 590,000 |

¹Yields were estimated for the period from 1930 to 1961 by correlations from available records.

Coquille Bay

Port commissions at Bandon and Broadbent serve the area [106]. Their addresses and phone numbers are:

Port of Bandon
P.O. Box 53
Bandon, Oregon
347-2669

Port of Coquille River
P.O. Box 1245
Broadbent, Oregon
572-5937

Drainage Basin

The estuary drainage basin, as shown in Tables 4 and 5, is 1,058 sq mi with an average fresh water yield of 2,400,000 ac-ft/yr, based on an estimated annual average yield of 2,270 ac-ft/sq mi. The area is rough and mountainous, consisting of approximately 88% (931 sq mi) forests, 5% (52 sq mi) cropland, and 6% (63 sq mi) rangeland [49,93].

Annual rainfall varies from 50 inches (at the mouth of the Coquille River) to 110 inches (near the headwaters of the South Fork Coquille River) [93]. Precipitation records from the Bandon and Coquille climatological stations described in Table 14 are available in punch card or printout form through the OSWRB [92,143].

Elevations range from sea level to 5,100 feet [93].

Stream profiles for the Coquille Bay river systems appear on page 63 in the Coos Bay Basin section.

Hydraulic Description of Estuary

Tides and Currents

The estuary is described as being fully exposed to waves at the throat [55]. Tidal effects on the Coquille River extend as far as from 36 to 40 miles (near Myrtle Point) upstream [53,93]. The mean tide range is 5.2 feet with a diurnal range of 7.0 feet [55] and an extreme range of 10.0 feet [86]. Tidal prism on mean range is 1.32×10^8 cu ft with a diurnal range of 1.77×10^8 cu ft [55].

River Discharges

Table 6 lists the mean, maximum, and minimum flow rates of the Coquille River and its major tributaries. These flow rates are either estimated monthly averages as presented in the "South Coast Basin" [93] or one-day

Coquille Bay

extremes recorded at USGS stations and published by that agency [140]. More information on the stream gaging stations is included in Table 14.

Salinity and Classification by Mixing

No information.

Table 6. Flow rates of Coquille Bay tributaries [93,140].

| stream | point of measurement | drainage area (sq mi) | period of record | flow rate (cfs) | | |
|----------------------------|---------------------------------|-----------------------|---------------------------|----------------------|-------------------------|-------|
| | | | | maximum | minimum | mean |
| Coquille River | mouth | 1,058 | none ¹ | 8,250 February | 130 September | 3,300 |
| North Fork Coquille River | near Myrtle Point | 276 | 1930-1946 ¹ | 2,450 February | 55 September | 1,000 |
| | near Fairview (river mile 21.7) | 74.0 | 10/63-(1970) ² | 4,660 1/65 | 2.0 10/67 | 289 |
| South Fork Coquille River | at Powers (river mile 29) | 169 | 1917*(1961) ¹ | 1,880 January | 32 September | 790 |
| | | | 9/16*(1970) ² | 48,900 (12/22/64) | 12 (9/61) | 784 |
| East Fork Coquille River | mouth | 135 | none ¹ | 1,050 February | 20 August, September | 400 |
| Middle Fork Coquille River | near Myrtle Point | 305 | 1931-1946 ¹ | 2,150 February | 25 September | 810 |

¹ Average flow rate by month was estimated for the period from 1930 to 1961 by correlations from available records [42].

² Extreme daily flow rates were recorded [27].

() This is the most recent record date found and is not necessarily the last.

* Period of record is not continuous

Sediments

Net transport of sediments in the area of Coquille Bay seems to be to the south with accretion being dominant at the south jetty. Accretion also occurs to some extent to the north where a spit has developed at the end of the Coquille River [57]. Sediments transported to the estuary each year are estimated to average 100,000 tons [85,86].

Dredge samples taken by the Corps of Engineers at the Coquille River entrance once in 1960 and twice in 1970 showed organic contents ranging

Coquille Bay

from 0.44% (August 1970) to 0.60% (November 1970); void ratios ranging from 0.376 (September 1960) to 0.660 (August 1970); and mean grain size either that of fine sand (August, November 1970) or medium sand (September 1960) [124].

Water Quality

The DEQ operates ten water surveillance stations in Coquille Bay (Table 14) [67,68]. Records have been kept since September 1968 with five or six measurements at most of the stations between then and March 1971.

The city of Bandon has a new (1971) sewage treatment plant [103], and the city of Coquille has a primary treatment facility available to industry [25] (Table 7). The only real pollution problem reportedly arises at Moore Mills (at Bandon) where dumping of sawdust and bark into the bay and log storage occur [81].

Table 7. Sewage treatment plants at Coquille Bay [25,101,103].

| | City of Bandon | City of Coquille |
|--------------------|---|------------------|
| completion date | 1971 | |
| location | Coquille River; south side; mile 0.5; in Bandon | |
| area served | 1/3 of the population | |
| number served | in 3/4 of the area of Bandon | |
| description | secondary | primary |
| average flow (mgd) | | |
| rainy | 0.473 (high monthly average) | |
| dry | 1.5 (high for one day) | |
| overall | 0.018 (low for one day) | |
| | 0.21 | |

Biological Information

Estimated numbers of anadromous salmonids spawning in the Coquille River system are as follows: spring chinook--50⁽¹⁾, fall chinook--4,900,

(1) A remnant run found mainly in the South Fork Coquille River.

Coquille Bay

coho--23,000, steelhead--16,100, and sea-run cutthroat--12,000. A comparison with other stream systems can be made from Table B [78]. During June, striped bass and shad spawn in the tidal portion of the Coquille River where brown bullhead (a warm-water game fish) can also be found [78]. Other common species include softshell clams (located in the tidal flats between the mouth and mile 3.5), surf smelt, perch, and dungeness crab [38,53,155].

Waterfowl use of the estuary up to Riverton near river mile 16.3 is estimated at 39,000 waterfowl use days per year, with white winged scoter (coot) being the most abundant [81]. American widgeon, pintails, wood ducks, american merganser, and surf scoters can be found to a lesser degree [78,81].

The most abundant shorebirds include great blue heron, gulls (western, herring, and California), belted kingfisher, and double crested cormorant. The common crow is also frequently found [81].

Some river otter, mink, and beaver inhabit the area around the estuary [81], and black-tailed deer (the most abundant big game animal of the South Coast Basin) use it as a wintering range. A section to the north of the estuary serves as a winter range for elk, and the Coquille watershed contains one of the largest Roosevelt elk herds in Oregon [78].

Physical Alterations

Alterations at Coquille Bay by the Corps of Engineers, described in Table 8, include two jetties and an entrance channel [126,129]. Statistics of project use have been included under "Estuary Uses." Records of dredging activities (also by the Corps of Engineers) between 1959 and 1969 (excluding 1968) show annual dredging of the entrance channel with 62,250 cu yds being a typical quantity removed [55].

Under the "Coastal 60-40 Stream Improvement Program," the Middle Creek Fishway, located 18 miles east of the city of Coquille on the Coquille River, was constructed by the FCO [119]. No completion date was given, but dedication of the fishway took place in 1963.

The OSGC operates a hatchery at Bandon from which a total of 799,771 fish were released in 1970. These consisted of 527,390 cutthroat trout, 241,618 summer steelhead, 24,610 rainbow trout, and 6,153 winter steelhead [80].

Industrial and Commercial

Lumber-related activities are of major economic importance to the area, although commercial and recreational fishing also provide some income.

Coquille Bay

Table 8. U.S. Army Corps of Engineers Modifications to Coquille Bay [126,128,129].

| Proposed Modification | Location | Dimensions | | | Date and Status |
|-----------------------|----------|-----------------|-----------------|------------|--|
| | | depth (feet) | width (feet) | length | |
| North Jetty | Entrance | | | 3,450 feet | 1908-completed 1942-reconstructed 1951-750-foot extension added to east end 1956-repaired |
| South Jetty | Entrance | | | 2,700 feet | 1908-completed 1954-repaired |
| Channel | Entrance | 13 | Suitable | 1.3 miles | 1933-completed |

Major manufacturers in the area, which are listed in Table 9, deal mostly in lumber and wood products. Lumber in coast wise trade accounted for 40% of the 370,000 tons using the Coquille channel project in 1969, and rafted logs accounted for the other 60%. (Traffic through the project between 1960 and 1969 averaged 446,000 tons [129].

Presented in Tables 10 and 11 are commercial fish landing statistics for the Coquille Bay area. In comparison with figures for commercial fishing at other estuaries included in this report (Tables D and E), these are quite low. Shad, striped bass, and crab are the primary species taken from the estuary, while salmon account for most of the landings received from the ocean [20,34,118]. In 1970, Bandon received 9% of the south coast salmon landings or roughly 270,000 pounds coho and 108,000 pounds chinook at a total value to fishermen of \$225,000 [78].

Recreational

Sports fishing for salmon and trout is quite popular (Table 12). Between mid-September and the first good high water in November, both chinook and coho abound, mainly in the lower 20 miles of the Coquille River. Most of the angling is by boat, with some along the shore in the upper reaches [58]. Other commonly-caught species (as determined in the study by the FCO between March and October 1971) include surf smelt, redbtail perch, and relatively few shiner perch by shore angling; dungeness crab by boat fishing; and softshell clams by clamming [38]. Some shad and striped bass are also taken--harvest data are included in Table 12.

Hunting for waterfowl along the first 16 miles of the Coquille River peaks in December and was estimated at 900 hunter days for 1970. There is exceptionally good pigeon hunting at Prosper (approximate river mile 4.5), but the area is now (1972) closed to public access. When open to the public, use averages 2,500 hunter days [81].

Coquille Bay

Table 9. Major Manufacturers at Coquille Bay [2,25,71].

| Location | Name | Type of Business | Number Employed |
|--------------|--|---|-----------------|
| Bandon | Moore Mill and Lumber Co. | lumber | 170 |
| | Rogge Lumber Sales Inc. | lumber | 90 |
| | 9 manufacturers employing less than 20 | dealing mainly in logging and food products | |
| Coquille | Georgia-Pacific Corp.-Coquille Plant | plywood, studs, chips | 300 |
| | Georgia-Pacific Corp. | plywood, lumber, and chips | 250 |
| | Gold Mountain Logging Co. | logging | 30 |
| | 11 manufacturers employing 10 or under | dealing mainly in lumber and wood products (mostly logging) | |
| Norway | Georgia-Pacific Corp. | veneer and chips | 85 |
| | Norway Archery | arrow manufacturer | 6 |
| Myrtle Point | Leep Logging Corp. | lumber | 40 |
| | Doyle Veneer | wood veneer | 29 |
| | 11 manufacturers employing 10 or under | dealing mainly in lumber and wood products (mostly logging) | |

There are boat ramps at the Port Docks in downtown Bandon, Bullards State Park, Rock Point at mile 2, Coquille at mile 24.2, and Arago at mile 32.4. The small boat basin at Bandon takes care of about 100 fishing and pleasure boats [2,96].

The City of Coquille has two parks (one developed and one not), and Bullards Beach State Park borders Coquille Bay and the ocean to the north. Attendance at Bullards Park by day visitors and campers showed a fairly steady increase from 1966 to 1970 with the exceptions of 1968 and 1969 when use by campers and day visitors, respectively, dropped. Figures given in Table 13 are for total park attendance for 1966 and 1970 only with estimates of the percentage of those attending who actually used the estuary portion of the park [82,83].

Coquille Bay

Table 10. Commercial Harvest of Shad, Striped Bass, and Crabs from Coquille Bay [20,118].

| Species | 1969 | | 1970 | | 1971 | |
|-----------------------------|---------------|-----------------|---------------|-----------------|---------------|-----------------|
| | pounds landed | fishermen value | pounds landed | fishermen value | pounds landed | fishermen value |
| Shad ⁽¹⁾ | 13,485 | \$2,000 | 7,430 | \$1,000 | 11,607 | \$2,000 |
| Striped Bass ⁽¹⁾ | 796 | | 395 | | 537 | 0 |
| Crabs ⁽²⁾ | | | 644 | | 0 | |

¹Source of reference [20]; data for Coquille Bay and its tributaries.

²Source of reference [118]; data for Coquille Bay.

Table 11. Commercial Harvest of Food Fish Received at Bandon, 1971⁽¹⁾ [34].

| Species | Harvest (pounds round weight) | Fishermen value |
|---------------|----------------------------------|--------------------|
| Coho | 440,728 | \$138,000 |
| Chinook | 48,113 | 27,000 |
| Crabs | 20,328 | 7,000 |
| Shad | 11,607 | 2,000 |
| Groundfish | 7,037 | 1,000 |
| Pinks | 1,912 | 1,000 |
| Albacore Tuna | 660 | — |
| Striped Bass | 537 | — |
| Totals | 530,922 | \$176,000 |

¹Includes 1971 data presented in Table 10.

Coquille Bay

Table 12. Estimated Annual Harvest Data for Sport Fishing at Coquille Bay⁽¹⁾ [78].

| Species | area fished | annual harvest (total number) | effort (angler-days) | gross expenditures |
|-------------------|-----------------------|-------------------------------|----------------------|--------------------|
| Salmon | Estuary | 1,300 | 3,250 | \$ 96,200 |
| | Coquille river system | 150 | 600 | 11,100 |
| | Ocean | 500 | 600 | 37,000 |
| Sea-run cutthroat | Coquille river system | 400 | 250 | 4,625 |
| Steelhead | Coquille river system | 3,500 | 14,000 | 259,000 |
| Shad | Coquille Bay | 250 | 115 | 2,127 |
| Striped bass | | 50 | 95 | 1,758 |

¹Average of data from past years.

Table 13. Bullards Beach State Park Annual Attendance, 1966 and 1970 [82,83].

| Park Users | 1966 attendance | | 1970 attendance | |
|---------------|-----------------|------------------------|-----------------|------------------------|
| | total park | estuary ⁽¹⁾ | total park | estuary ⁽¹⁾ |
| day visitors | 222,712 | < 1,114 | 292,312 | < 1,462 |
| camper nights | 34,265 | < 171 | 50,601 | < 253 |

¹Actual use of the estuary portion of the park estimated to be less than 0.5% of the total attendance.

Coquille Bay

Table 14. Surveillance stations at Coquille Bay.

| type of station | name and/or identifying number | approximate location | drainage area (sq mi) | period of record | reference |
|------------------------|--|--|-----------------------|------------------------------|--------------------------|
| climatological | Bandon (formerly Coquille R.L.H., Bandon 2E) | Coquille River; mile 0.5 | | 1887-1960 | [92,93,143] ¹ |
| | Coquille | Coquille River; mile 25 | | 1942-1954 | [92,93] ¹ |
| stream gaging | North Fork Coquille River near Myrtle Point; USGS #3270 | North Fork Coquille River; mile 4.30 | 282 | 1929-1946 | [98] ² |
| | North Fork Coquille River near Fairview; USGS #3268 | North Fork Coquille River; mile 21.7 | 74 | 1963-(1970) | [98,140] ² |
| | South Fork Coquille River at Powers; USGS #3250 | South Fork Coquille River; mile 29 | 169 | 1916-(1970) | [98,140] ² |
| | Middle Fork Coquille River near Myrtle Point; USGS #3265 | Middle Fork Coquille River; mile 2.2 | 305 | 1931-1946 | [98] ² |
| crest stage gaging | Geiger Creek near Bandon; USGS #3271 | | 1.36 | 1953-(1961) | |
| DEQ water surveillance | #1 | Coquille Bay; channel next to old lighthouse | | 9/68-(7/70) (5 measurements) | [67,68] ³ |
| | #2 | Coquille Bay; next to Coast Guard Station, 40 yards from south shore | | 9/68-(3/71) (6 measurements) | " |
| | #3 | Coquille Bay; red channel buoy #14 | | 9/68-(3/71) (6 measurements) | " |
| | #4 | Coquille Bay; channel opposite Moore Lumber Mill, Bandon | | 9/68-(7/70) (5 measurements) | " |
| | #5 | Coquille Bay; channel at Highway 101 bridge | | 9/68-(3/71) (6 measurements) | " |
| | #6 | Coquille Bay; channel at Riverton Ferry | | 9/68-(3/71) (5 measurements) | " |

Coquille Bay

Table 14. Surveillance stations at Coquille Bay, cont.

| type of station | name and/or identifying number | approximate location | drainage area (sq mi) | period of record | reference |
|------------------------|---|---|-----------------------|---------------------------------|----------------------|
| DEQ water surveillance | #7 | Coquille Bay; channel at Coquille STP outfall (50 yards below highway bridge) | | 9/68-(3/71) (6 measurements) | [67,68] ³ |
| | #8 | Coquille Bay; channel, 1/2 mile below highway bridge | | 9/68-(7/70) (3 measurements) | " |
| | #9 | Coquille Bay; channel at Rink Creek | | 9/68-(3/71) (4 measurements) | " |
| | #10 | Coquille Bay; channel, 1 mile upstream from station #9 | | 9/68-(3/71) (4 measurements) | " |
| water quality | North Fork Coquille River near Myrtle Point | North Fork Coquille River; mile 4.3 | | 1960-(1961) | [93] |
| water temperature | Ferry Creek at hatchery | Ferry Creek; mile 2 (about 3 miles from the estuary mouth) | | 1943-1956 | [93] |

¹Precipitation data available in punch card or printout form through the OSWRB.

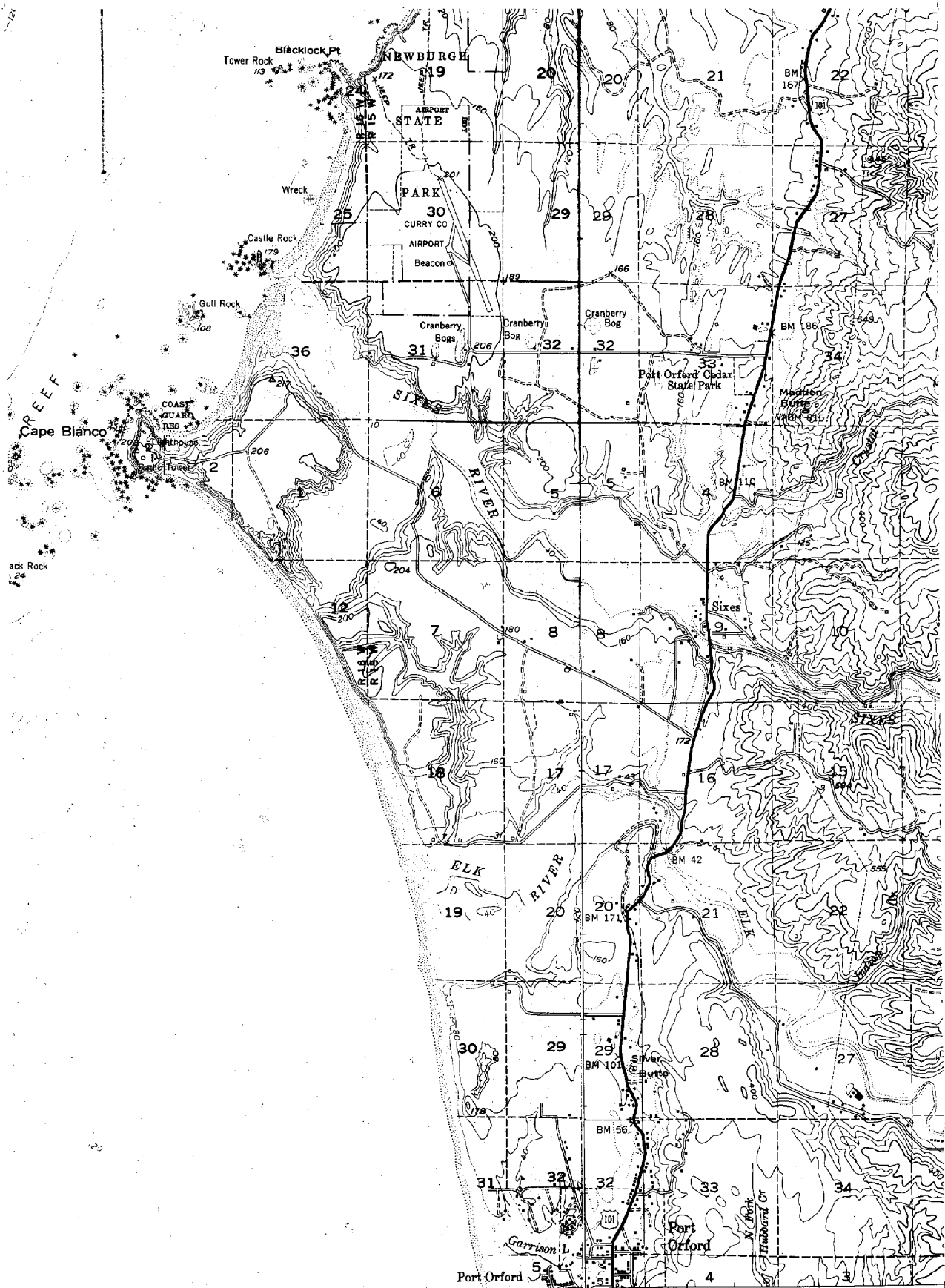
²Monthly and water-year runoff records have been compiled and are available in punch card or printout form through the OSWRB.

³Data available in punch card or printout form through the DEQ.

() This is the most recent record date found and is not necessarily the last.

* Period of record is not continuous.

ELK RIVER



INTERIOR-GEOLOGICAL SURVEY, WASH. D.C.-1963

MR 6175

(FORT ORFORD) 124°30'

375000m.E.

OPHIR 21 MI.

GOLD BEACH 33 MI.

R. 15 W.

ELK RIVER

General Description of Estuary and Drainage Basin

Estuary

The Elk River Estuary lies approximately 237 miles south of the Columbia River mouth. It ranks as one of the smallest in size in terms of surface area. Port Orford is the nearest populated community which is located 1 mile south of the Coast Highway Bridge (U.S. 101) that crosses the Elk River. Census figures for Port Orford appear in Table 1.

Table 1. Population Centers Near
Elk River [9,96,111,134].

| Name | General Location | River Mile location | 1970 Population |
|----------------|---|------------------------|--------------------|
| Port Orford | 1 mi. south of Elk R. Coast Hwy. Br. (u.S. 101) | not applicable | 1,037 |

The HW surface area of the estuary as estimated from 1973 EROS Data Center aerial photographs is 290 acres [135].

The average annual yield of the Elk River at its mouth was 330,000 ac-ft for the period of 1930-1961. The minimum annual yield was 180,000 ac-ft, and the maximum, 470,000 ac-ft. The Elk River source is at river mile 29.8, elevation 890 feet (river mile 29.8 is the confluence of the North Fork and the South Fork of the Elk River) [93,96].

The Port of Port Orford is located at P.O. Box 227, Port Orford, Oregon, 97465; telephone number 332-3281 [106].

Drainage Basin

The Elk River drains a total basin area of 94 sq. miles. The average yearly freshwater yield of the Elk River is 330,000 ac-ft which equals an average annual precipitation of 66 inches over the basin [93].

The Elk River Basin consists primarily of woodlands (96.1%; 58,766 acres), croplands (3.0%; 1,814 acres), and pasture (1.0%; 180 acres). As of January, 1963 the Elk River had no existing storage ponds or reservoirs, but had 2 potential reservoir sites being studied.

The average annual precipitation ranges from 65 inches at the mouth of the Elk River to 120 inches in the upper reaches [93].

ELK RIVER

General Description of Estuary and Drainage Basin

Estuary

There are two climatological stations in the vicinity of the Elk River Estuary. The Cape Blanco station has precipitation and temperature data from 1952 and the Port Orford station has precipitation and temperature data from 1852 to 1856 and from 1905 to the present. (See Table 7) [93,143].

The Elk River has a length of 29.8 miles to the confluence of the North Fork and South Fork, the North Fork Elk River having an additional length of 5 miles. The elevation drop from the source to the mouth for the Elk River is 890 feet and 2,080 feet for the North Fork. The average gradient for the Elk River is 30 feet per mile and 400 feet per mile for the North Fork [93].

Elk River stream profile appears in page 63 in the Coos Bay Basin section.

Hydraulic Description of Estuary

Tides and Currents

According to the U.S. Geological Survey the average range of the tide is approximately 5 feet [144].

It appears that the mouth of the Elk River Estuary may migrate several hundred yards and change its position periodically due to the sand bar and the coastline characteristics at the mouth. During the summer months the sand bar prevents saline water from entering the estuary except during periods of extremely high tides.

River Discharges

Stream flow records are available from the USGS stream gaging station on the Elk River at river mile 3.2. The station is discontinued, but records are available for data taken between October, 1967 and June, 1970. Spot observations are available for years 1926, 1931-32, 1934-38, and 1949 to 1952 [148].

Table 2. Stream Gaging Data [148].

| Stream | Location (river mile) | Drainage area (sq.mi.) | Complete water years of record | Flowrate (cfs) | | |
|-------------------------------|--------------------------|------------------------------|--------------------------------------|----------------|------|------|
| | | | | max. | min. | mean |
| Elk River near Sixes, Ore. | 3.2 | 86.1 | Oct., 1967- June, 1970 | 14,300 | 48 | 610 |

ELK RIVER

Hydraulic Description of Estuary

Salinity and Classification by Mixing

Salinity profiles as a function of depth and distance from the mouth of the river are presented in Table 3. Data was taken on August 22, 1973 during a high tide of +7.5 feet [87].

Table 3. Salinity Values for the Elk River Estuary.* Aug. 22, 1973 [87].

| Station | Distance from mouth (mi.) | Salinity % | | Depth (ft.) |
|---------|------------------------------------|------------|--------|----------------|
| | | top | bottom | |
| 1 | 0.1 | 0.2 | 0.2 | 1 |
| 2 | 0.2 | 0.2 | 0.2 | 2 |
| 3 | 0.3 | 0.2 | 0.2 | 2 |
| 4 | 1.4 | 0.2 | 0.2 | 3 |
| 5 | 1.6 | 0.2 | 0.2 | 5 |
| 6 | 1.7 | 0.2 | 0.2 | 7 |
| 7 | 1.9 | 0.2 | 0.2 | 5 |

* The Elk River mouth was almost completely closed off by sand bars and no saline water entered the estuary except for extremely high tides.

Sediments

Cliffs and small embayments characterize the shoreline south of Cape Blanco. The narrow beaches in the area are composed of coarse sands and gravels. From Cape Blanco (through Port Orford) the beach is narrow with mountainous uplands, partially developed with residences.

According to the National Shoreline Study by the U.S. Army Corps of Engineers, (Aug., 1971), the shoreline at Cape Blanco to the north of the estuary is experiencing non-critical erosion. The beaches in the immediate vicinity of the Elk River Estuary are experiencing no erosion [125].

ELK RIVER

Hydraulic Description of Estuary

Sediments

The generalized sediment yield for the Elk River basin is 0.1 to 0.5 ac-ft per sq. mile per year [23].

Water Quality Information

Miscellaneous flow and temperature measurements for the basin were made by the Oregon State Game Commission. Temperature ranges from these sources are presented in Table 4 [78].

Table 4. Temperature Extremes for Elk River Drainage Basin [78].

| Point of measurement | Period of record | Observed temperature extreme (F°) | | |
|------------------------------------|----------------------|-----------------------------------|------|---------------------|
| | | max. | min. | type of observation |
| Elk River river mile 3.5 | 4-8-69 to 7-22-69 | 70 | 51 | spot |
| Elk River below Bald Mtn. Creek | 4-8-69 to 7-22-69 | 69 | 49 | spot |
| Elk River above Butler Creek | 4-8-69 to 7-22-69 | 69 | 49 | spot |
| Elk River above Blackberry Cr. | 4-8-69 to 7-22-69 | 69 | 49 | spot |
| Anvil Creek mouth | 4-8-69 to 7-22-69 | 62 | 50 | spot |
| Bald Mtn. Creek mouth | 4-8-69 to 7-22-69 | 67 | 49 | spot |
| Purple Mtn. Creek mouth | 4-8-69 to 7-22-69 | 56 | 49 | spot |
| Panther Creek mouth | 4-8-69 to 7-22-69 | 67 | 48 | spot |
| Butler Creek mouth | 4-8-69 to 7-22-69 | 65 | 47 | spot |
| Blackberry Cr. mouth | 4-8-69 to 7-22-69 | 61 | 47 | spot |

DEQ water quality stations are listed in Table 7.

ELK RIVER

Biological Information

Estimates of the number of adult anadromous salmonids in the Elk River system are as follows: spring chinook--none, fall chinook--3,200, coho--800, steelhead--3,500, and sea-run cutthroat--2,800. The Elk River is considered to be one of the most important fall chinook streams on the Oregon Coast [78,93].

Dace, cottids, red-sided shiners, sticklebacks, lamprey, and suckers are the known rough fish species in the stream systems of the South Coast Basin [78].

Low natural summer runoff coupled with extensive streamside logging in the Elk River watershed contribute to warm stream flow conditions during the summer. The Elk River is also affected by siltation and logjams [78].

The Elk River system has 10 streams used by adult anadromous salmonids, 8 of which have minimum flow recommendations established and 1 protected by the State Water Resources Board.

Table 5 refers to the estimated sport harvest in the Elk River system.

Table 5. Estimated Annual Harvest, Angler Days, and Gross Expenditures for Angling in the Elk River System [78].

| Fish | Harvest | Angler Days | Gross Expenditures |
|-------------------|---------|-------------|--------------------|
| Salmon * | 4,200 | 16,800 | \$310,800 |
| Steelhead | 1,200 | 4,800 | 88,800 |
| Sea-run Cutthroat | 300 | 200 | 3,700 |
| TOTALS | | 21,800 | \$403,300 |

* Includes jack salmon

The Elk River Estuary is small in size, but this estuary, along with the Sixes, Pistol, Chetco, and Winchuck is very important to the survival of salmon and steelhead.

Figure 1 is a periodicity chart showing when adult spawning anadromous fish are present in the Elk River system.

Figure 1. Periodicity Chart for Adult Spawning
Anadromous Fish in the Elk River System [78].

Chinook Salmon *****

Coho Salmon -----

Steelhead and
Cutthroat trout ::::::::::::::::::::

| Stream | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | April | May |
|-----------------------|-------|------------|------------|------------|------------|------------|------------|------------|
| Elk River | ***** | ***** | ***** | ***** | ***** | | | |
| | | ----- | ----- | ----- | ----- | | | |
| | | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: |
| Anvil Creek | ***** | ***** | ***** | ***** | ***** | | | |
| Bald Mountain Creek | ***** | ***** | ***** | ***** | ***** | | | |
| | | ----- | ----- | ----- | ----- | | | |
| | | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: |
| Butler Creek | ***** | ***** | ***** | ***** | ***** | | | |
| | | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: |
| Elk River, North Fork | | | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: |
| Elk River, South Fork | | | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: |
| Blackberry Creek | | | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: |
| Panther Creek | ***** | ***** | ***** | ***** | ***** | | | |
| | | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: |
| Red Cedar Creek | | ***** | ***** | ***** | ***** | | | |
| | | ----- | ----- | ----- | ----- | | | |
| | | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: |

ELK RIVER

Biological Information

A general description of big game, upland game, waterfowl, and furbearers of the basin is given in the Sixes River section on Biological Information.

Physical Alterations

The only physical alteration near the estuary is the Oregon Coast Highway Bridge (U.S. 101), at river mile 3.2 [96].

Estuary Uses

Industrial and Commercial

Irrigation, mining, and gravel removal are the basic industrial and commercial uses of the Elk River. The average annual yield of the Elk River is 330,000 ac-ft while the legal annual depletion is 1,000 ac-ft and the estimated actual annual consumption is 900 ac-ft. The Elk River has 1 reservoir right issued for industrial purposes with a total of 32 ac-ft storage capacity and a surface area of 5 acres. Surface water rights include 3.99 cfs consumptive for domestic, irrigation, and industrial purposes.

Chromite, gold, quicksilver, and coal are mined in the watershed [93].

Port Orford manufacturers are listed in Table 6.

Recreation

The principal attraction of the basin is the Pacific Ocean. The large forest areas covering the slopes of the Coast Range which include the Siskiyou National Forest provide excellent hunting.

Parts of the Elk River flow through the northern portions of the Siskiyou National Forest. Several streams in the basin have outstanding aesthetic value and make a significant contribution simply because they maintain attractive flows, have little streamside development, and possess watersheds that have not been excessively logged. The Elk River above Anvil Creek was selected by the Oregon State Game Commission as a stream which should be managed for its aesthetic value [78,93].

ELK RIVER

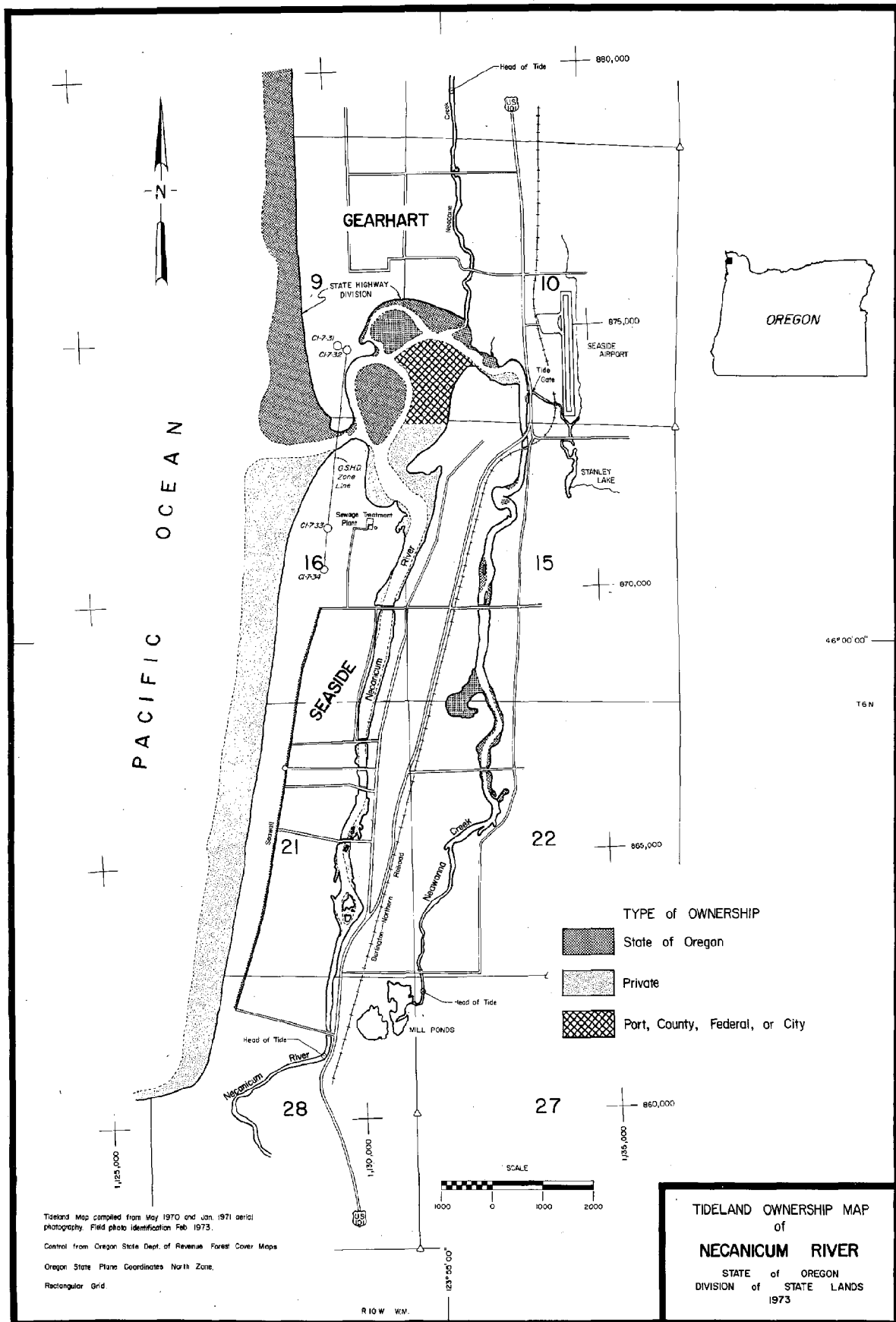
Table 6. Major Manufacturers at
Port Orford, Oregon [71].

| Location | Name | Type of Business | Number Employed |
|-------------|------------------------------------|--|-----------------|
| Port Orford | Cape Fisheries Inc. | Canned and Cured Fish and Seafoods | 75 |
| " | Walter and Allen Cram Co. | Logging Camps and Logging Contractors | 5 |
| " | Laird Logging Co. | " | 100 |
| " | N.B. Marsh Logging Co. | " | not listed |
| " | Stole and Bens Loggers | " | 4 |
| " | Western States Plywood Cooperative | Veneer and Plywood | 245 |
| " | Port Orford Press | Newspapers-Publishing, Publishing and Printing | 2 |

Table 7. Surveillance Stations near the
Elk River Estuary

| Type of | Name and/ or identifying number | Approximate location | Drainage area (sq.mi.) | Period of record | Reference |
|----------------|---|-----------------------------------|------------------------|-------------------------|-----------|
| Climatological | Cape Blanco | T32S, R16W Sec. 2 | | 1952-present | [93] |
| " | Langlois | T13S, R15W Sec. 35 | | 1891-1904 | " |
| " | Langlois 2 (Formerly Denmark, Willow Creek) | T13S, R15W Sec. 2 | | 1922-present | " |
| " | Port Orford (Formerly the Heads) | T33S, R15W Sec. 8 | | 1852-1856, 1905-present | " |
| Water Quality | Elk River 1 mi. above Hwy 101 Bridge | T32S, R15W Sec. 21 river mile 4.5 | | | [152] |

NECANICUM RIVER



NECANICUM RIVER

General Description of Estuary and Drainage Basin

Estuary

The Necanicum River Estuary lies approximately 16 miles south of the Columbia River mouth. Of the estuaries included herein, it ranks among the smallest in size. Towns located on or near the estuary include Seaside and Gearhart. Locations and 1970 populations are given in Table 1 [95,111,129].

Table 1. Population Centers at Necanicum River
[9,95,111,134]

| Name | General Location | River Mile Location | 1970 Population |
|----------|-----------------------------------|---------------------|-----------------|
| Seaside | Necanicum R., S. Side at mouth | 0 to 2.9 | 4,402 |
| Gearhart | Necanicum R., N. Side | 0 to 0.9 | 820 |

Tidal reach is approximately 3.0 miles from the mouth of the Necanicum [87].

The estuary measures less than 2,000 feet at its mouth and covers about 278 acres [66]. Maximum depth varies from 9 to 12 feet becoming very shallow at the mouth [87].

The estuary consists of the Necanicum River, Neawanna Creek, and Neacoxie Creek. The Necanicum-Neawanna system drains an area of 87 sq. miles with the source of the Necanicum at river mile 21.2, elevation 1,360 feet.

The mouth of Neawanna Creek enters the estuary from the North bank at river mile 0.2. Neawanna Creek is approximately 7 miles in length with its source at an elevation of 880 feet.

The mouth of Neacoxie Creek enters the estuary from the North bank of river mile 0.2 also. The Neacoxie Creek is less than 4 miles in length with its source at Sunset Lake, elevation approximately 25 feet [95,123,129].

Drainage Basin

The Necanicum River-Neawanna Creek system drains a total area of 87 sq. miles. The average yearly freshwater yield of the system is 220,200 ac-ft with an average annual precipitation of 100 inches. The basin consists primarily of forests (93.6%; 40,500 acres), cropland (1.2%; 500 acres), and rangeland (1.2%; 500 acres).

NECANICUM RIVER

General Description of Estuary and Drainage Basin

Drainage Basin

Frequently flooded areas along the Necanicum average 150 acres. As of June, 1966, the Necanicum River had 4 storage ponds and 1 storage reservoir with no plans for future reservoir sites.

The average annual precipitation ranges from 85 inches at Seaside to over 110 inches at the headwaters of the Necanicum [115].

The Seaside surveillance station has recorded climatological data from 1931 to the present.

The Necanicum River stream profile appears on page 221 in the Tillamook Basin section.

Hydraulic Description of Estuary

Tides and Currents

In an effort to determine the precise elevations of mean high water (MHW) in the Necanicum River Estuary, the Portland District, U.S. Army Corps of Engineers, in cooperation with the National Ocean Survey, in the fall of 1971 installed two temporary tide gauging stations in the Necanicum River at Seaside, one located at the 12th Street Bridge and the other near the City of Seaside Sewage Treatment Plant. A third temporary tide gauging station was installed in the Pacific Ocean near Indian Beach at Ecola State Park. Analyses of continuous measurements of tidal fluctuations at these three stations show the tidal datum plane for those stations as follows in Table 2. The tidal prism is equal to approximately 1,350 ac-ft of water [27].

Table 2. Tidal Fluctuations for the Necanicum Estuary [27].

| Datum Plane | Elevation of Datum Plane (feet) | | |
|----------------|------------------------------------|---|------------------------------|
| | Sewage Plant | Seaside ¹ 12th St. Bridge | Indian Beach ² |
| MHHW | 4.9 | 5.3 | 4.1 |
| MHW | 4.2 | 4.6 | 3.4 |
| SLD | 0.0 | 0.0 | 0.0 |
| MLW | | | -2.6 |
| MLLW | | | -3.9 |

MHHW=Mean Higher High Water MHW=Mean High Water

SLD=Sea Level Datum MLW=Mean Low Water

MLLW=Mean Lower Low Water

¹Two months of observation, Nov. and Dec. 1971

²31 high and low waters, observed from Jan. 27 to Feb. 14 1972

NECANICUM RIVER

Hydraulic Description of Estuary

Tides and Currents

Head of Tide is at about river mile 2.7 in the Necanicum (near the golf course footbridge) and at about river mile 3.8 in Neawanna Creek (400 ft. from the mill ponds) [73,87].

River Discharges

Stream flow records are available from the USGS stream gaging station on the South Fork of the Necanicum River near Seaside, Oregon. The station, no longer operating as of 1968, was located at the Seaside water supply dam on Hollenback road, 1.4 miles upstream from the mouth and 8 miles southeast of Seaside.

The drainage area at the station is 7.99 sq. miles or 9.2% of the drainage area of the total system. Streamflow averages and extremes for the station are given in Table 3 [147].

Table 3. Flowrates for South Fork of Necanicum River [146,147].

| Stream | Point of Measurement (river mile) | Drainage area (sq.mi.) | Complete water Years of record | Flowrate (cfs) | | |
|----------------------|--------------------------------------|---------------------------|-----------------------------------|----------------|------|------|
| | | | | max. | min. | ave. |
| S. Fork Necanicum | 12.8 | 7.99 | 1953-1968 | 3040 | 1310 | 1965 |

The Portland District, U.S. Army Corps of Engineers, by use of the regional frequency approach, and basin characteristics (mean annual precipitation \approx 100 inches per year, river length = 21 miles, average stream surface slope = 65 feet per mile) arrived at these estimates for peak river discharges for the Necanicum River [27].

| FLOOD | PEAK DISCHARGES |
|--------------------|-----------------|
| 2-year frequency | 6,000 cfs |
| 5 year frequency | 7,900 cfs |
| 10-year frequency | 9,000 cfs |
| 25-year frequency | 10,300 cfs |
| 50-year frequency | 11,200 cfs |
| 100-year frequency | 12,000 cfs |

Average monthly flows are given in Table 4 from the Oregon State Water Resources Board, 1972.

NECANICUM RIVER

Table 4. Average Monthly Flows for Necanicum River [140].

| | Average Monthly Flows | | |
|-----------|-----------------------|-----|-----|
| | (cfs) | | |
| | 20% | 50% | 80% |
| October | 380 | 197 | 56 |
| November | 982 | 626 | 298 |
| December | 1286 | 836 | 565 |
| January | 1228 | 843 | 534 |
| February | 1153 | 843 | 546 |
| March | 867 | 616 | 415 |
| April | 588 | 401 | 234 |
| May | 255 | 169 | 103 |
| June | 148 | 98 | 59 |
| July | 63 | 42 | 26 |
| August | 30 | 23 | 16 |
| September | 52 | 26 | 14 |
| Total | | | |

S.M. 0- Correlated with Youngs River at S.M. 9.7 by Area-Preci-.

Area= 70 sq. mi.

Area-Precip.= 417,837 Ac.-Ft. Calculated by SWRB '72]

NECANICUM RIVER

Hydraulic Description of Estuary

Salinity and Classification by Mixing

The open estuary north of the Seaside Sewage Treatment Plant, during periods of flood tide, has a general salinity of that comparable to the adjacent Pacific Ocean, which salinity is only slightly reduced in concentration by fresh-water flows of the river during ebb-tide periods.

South of the Sewage Treatment Plant, the full depth of the river estuary, particularly along the bottom levels, will show evidence of salinity concentrations during the flood tide periods, which may diminish in concentrations, particularly in the upper levels, during ebb-tide periods [27].

These conditions were observed on August 17, 1973 during flood tide of approximately +7.0 feet. Results are given in Table 5 [87].

Table 5. Salinity Values for the Necanicum River Estuary Aug. 17, 1973 [87].

| Station | Distance from mouth (mi) | Salinity % | | Depth (ft.) |
|---------|-----------------------------------|------------|--------|----------------|
| | | top | bottom | |
| 1 | 0.6 | 26.9 | 26.9 | 2 |
| 2 | 0.8 | 23.3 | 26.9 | 4 |
| 3 | 0.9 | 23.3 | 26.9 | 5 |
| 4 | 1.3 | 22.0 | 26.9 | 8 |
| 5 | 1.8 | 22.0 | 26.9 | 9 |
| 6 | 2.1 | 19.9 | 26.9 | 9 |
| 7 | 2.3 | 19.2 | 26.2 | 5 |
| 8 | 2.9 | 3.0 | 26.2 | 4 |
| 9 | 3.0 | --- | ---- | 2 |

Sediments

The processes of sedimentation are apparently active in the open estuary area as evidenced by the migration of the outlet channel to and including the year 1968. Such migration of that channel is the direct result of the deposition of sediments during periods of low flow when velocities are insufficient to support the transportation of suspended sediments.

NECANICUM RIVER

Hydraulic Description of Estuary

Sediments

The deposition of these sediments in the channel raises the elevation of the water surface and thus imposes an increased hydraulic gradient with respect to downstream areas. The creation of this gradient and the influence of gravity causes the flow to take the most direct course which, almost invariably, results in a change in the direction of flow and thus, migration of the channel [27].

According to the U.S. Army Corps of Engineers National Shoreline Study, the ocean beaches south of the Necanicum Estuary to Tillamook Head are experiencing non-critical erosion while those north of the estuary are experiencing no erosion [125].

The generalized sediment yield for streams in the area is 0.1 to 0.2 ac-ft per sq. mile per year [23].

Predominant direction of littoral movement is from north to south. In this area, waves approach the coast from the northerly sector 49.25 per cent of the time and from the southerly sector 31.71 per cent of the time.

Water Quality Information

Miscellaneous flow and temperature measurements for the basin were made by the Oregon State Game Commission. Temperature ranges from these sources are presented in Table 6 [77].

Table 6. Temperature Extremes for Necanicum Drainage Basin [77].

| Point of Measurement | Period of Record | Observed Temperature Extremes (°F) | | |
|-------------------------------------|--------------------|------------------------------------|------|---------------------|
| | | max. | min. | Type of observation |
| Necanicum River below Klootchie Cr. | 4-7-71 to 8-21-71 | 67 | 45 | spot |
| Necanicum River above Bergsrik Cr. | 1-7-71 to 8-5-71 | 65 | 43 | spot |
| Klootchie Cr. mouth | 1-7-71 to 11-16-71 | 66 | 43 | spot |
| South Fork Necanicum River mouth | 1-7-71 to 11-16-71 | 64 | 43 | spot |
| North Fork Necanicum River mouth | 3-24-71 to 7-20-71 | 72 | 45 | spot |

NECANICUM RIVER

Water Quality Information

There is one sewage treatment plant in Seaside built and expanded between years 1940 through 1962. It is of the trickling filter type for a design population of 4,000 and a design flow of 1 MGD. The estimated population served in 1967 was 3,600. The Necanicum River is the receiving stream. The Oregon State Sanitary Authority recommended that additions to enlargement or improvement of the existing facility at Seaside be completed by July 1972. The cost of the recommended work, which consisted of interceptors and additional treatment works, was estimated at \$75,000 [84].

DEQ water quality stations are listed in Table 8.

Biological Information

Estimates of the number of adult anadromous salmonids spawning in the Necanicum River system are as follows: spring chinook--none; fall chinook--none; coho--3,780; chum--100; winter steelhead--2,000; summer steelhead--none; and sea-run cutthroat--2,000 [77].

Other fish in the estuary include herring, sculpins, perch and flounder [66].

The Oregon State Game Commission recommends that the Necanicum River be protected against gravel removal above Meyer Creek. It was also determined that a possible reservoir site on the South Fork Necanicum River (T5N-R9W-S29) is thought compatible with fishery resources [77].

Species of wildlife present in the basin are Black-tailed deer, Roosevelt elk, muskrats, minks, raccoons, otters, beavers, opossum, and bobcats. The principal upland game birds are mountain quail, ruffed grouse, and band-tailed pigeons. A few ring-neck pheasants and California quail are also in the area [133].

Due to the combination of high density sand and coastal configuration, the 20 mile long beach from Seaside to the Columbia River entrance is ideal for razor clams [74].

Physical Alterations

At the Necanicum River entrance construction of a sand spit in the open estuary beginning in late 1967, directed estuarine flows to the Gearhart shores, causing erosion of that shoreline as well as erosion of the Pacific shore for a distance of about 4,000 feet immediately north of the entrance.

Sunset Cove, Inc., a land development firm, contracted the sand spit on which the City of Seaside is located during the period between November, 1967, and November 1969 without benefit of legal permit. Some 375,000 cubic yards of sand were relocated from the firm's property and the adjacent public beach area in the direction of the sand spit.

NECANICUM RIVER

Physical Alterations

The original construction also included the riprapping of the western perimeter of the raised area to protect it from storm and ocean erosion. In November, 1969, the protection was extended some 500 feet northward and around the northeast corner of the sandfill site. Later in May, 1970, as the result of high tides, snow-melt streamflow and its natural tendency to meander, the course of the Necanicum River outlet shifted to the south and attacked the northern extremity of the elevated sand spit, necessitating emergency repairs [27].

The U.S. Army Corps of Engineers has completed projects for the protection of public works from flood hazard totalling \$46,600 as of 1971. Also, a survey report was authorized to determine the feasibility of providing a small-boat basin at the south end of the ocean beach at Seaside, near Tillamook Head. Completion of that report has been postponed until it has been determined whether a qualified local sponsor for the project can be found [129].

Records of bank protection, fill, piling, revetment, and sub-surface cable permits issued for the Necanicum River estuary are kept by the U.S. Army Corps of Engineers, Portland District.

There are seven small bridges crossing the Necanicum River Estuary at the City of Seaside [116].

Estuary Uses

Industrial and Commercial

Clatsop County relies heavily on fisheries and an expanding forestry industry for its livelihood. Total timber production in the county was 303 billion board feet in 1970, employing 1,020 persons in the industry with annual wages directly and indirectly related to the timber industry averaging \$35,000,000.

Farmland in the county totals 39,501 acres and is devoted largely to forest products and forage for cattle and other livestock. Increased industrialization and the growing need for housing space will continue to put a stress on the farm economy of Clatsop County, according to the Oregon Department of Geology and Mineral Industries.

Mink raising is favored by the nearby supply of abundant fish meal, and in 1967, 34 farms were raising a total of 34,000 female minks [116].

Table 7 lists major manufacturers in the Necanicum area.

NECANICUM RIVER

Estuary Uses

Recreational

Tourism added \$10 million to the local economy of Clatsop County in 1965 and officials estimate that the industry is expanding at a rate of 30 per cent per year. Attractions include sightseeing, beach activities, fishing, big-game hunting, and boating. Points of interest in the immediate vicinity of Seaside are Ecola State Par, The Lewis and Clart Salt Cairn Historic marker, and the ocean beaches [116].

The estimated angler catch for Necanicum Bay was 9,000 fish in 1970 with an effort of 1,800 angler-days expended as estimated by the Oregon State Game Commission [77].

NECANICUM RIVER

Table 7. Major manufacturers in Necanicum River Estuary
[71].

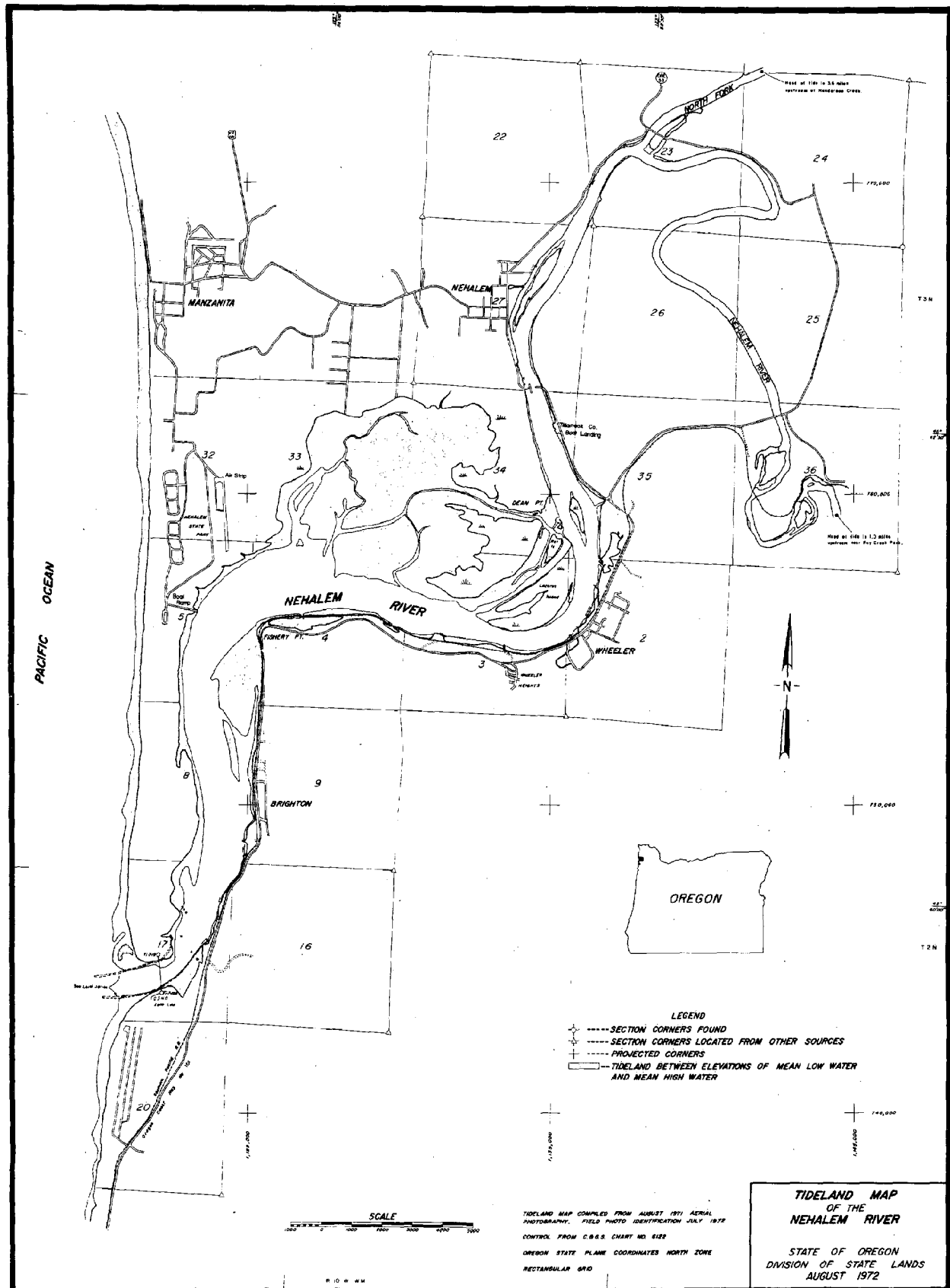
| Location | Name | Type of Business | Number Employed |
|----------|---------------------------|--|--------------------|
| Seaside | Bell Bouy Crab Co. | Canned and Cured Fish and Seafoods | 45 |
| " | Harrison's Bakery | Bread and other Bakery products | 13 |
| " | Phillips Candies | Candy and other Confectionery products | 14 |
| " | Burke Logging Co. | Logging camps and Logging Contractors | 5 |
| " | Crown Zellerback Corp. | " | 375 |
| " | Kohl Inc. | " | 12 |
| " | Olson Logging, Ben | " | 12 |
| " | Ordway Logging Co. | " | 8 |
| " | Shaw Co., | " | 14 |
| " | Waterhouse Logging Co. | " | 20 |
| " | Wilson Logging Co., Ed Q. | " | 14 |
| " | Seaside Publishing Co. | Newspapers-Publishing, Publishing and Printing | 8 |
| Gearhart | Gilmore, Andy & Lyle | Logging Camps and Logging Contractors | 8 |
| " | Wren Logging Co. | " | 18 |

Necanicum River

Table 8. Surveillance Stations at Necanicum

| Type of Station | Name and/or Identifying | Approximate Location | Drainage area | Period of record | Reference |
|--------------------|---|---|------------------|---------------------|-----------|
| Climatological | Seaside | Lat 45° 59' Long. 123° 55' El. 10 | | 1931-1971 | [143] |
| Stream Gaging | S. Fork Necanicum USGS #14-299000 | Lat 45° 53' Long. 123° 50' | 7.99 | 1953-1963 | [140] |
| Water Quality | Necanicum R. near mouth | River mile 0.1 | | | [152] |
| " | Necanicum R. near 12th Ave. Bridge | River mile 1.3 | | | " |
| " | Necanicum R. near Golf Course Rd. Bridge | River mile 2.9 | | | " |
| " | Necanicum R. near Hwy 101 & Hwy 26 | River mile 5.8 | | | " |
| " | Neawanna Cr. near 12th Ave. Bridge | River mile 1.6 | | | " |
| " | Neacoxie Cr. near Gearhart | River mile 0.5 | | | " |
| " | Neacoxie Cr. near Golf Course Rd. | River mile 1.4 | | | " |
| C | Neacoxie Cr. near Surf Pines Rd. | River mile 3.0 | | | " |

NEHALEM BAY



NEHALEM BAY

General Description of Estuary and Drainage Basin

Estuary

Nehalem Bay is located about 40 miles south of the mouth of the Columbia River. Although relatively large in size (Table A), population is sparse. The three incorporated towns in the area--Manzanita, Wheeler, and Nehalem--had a combined 1970 population of less than 900. These and other population centers are given in Table 1 [89,95,111].

Table 1. Population centers at Nehalem Bay¹ [89,95,111].

| name | general location | river mile location | approximate distance from estuary mouth (miles) | 1970 population |
|------------------------|---|---------------------|---|-----------------|
| Manzanita ² | coast; 3.5 miles north of the estuary mouth | | | 365 |
| Bayside Garden | | | | 120 |
| Jetty | Nehalem Bay; south side | -- | 0.5 | not listed |
| Brighton | Nehalem Bay; south side | -- | 1 | 60 |
| Wheeler Hts. | Nehalem Bay; south side | -- | 4 | 70 |
| Wheeler ² | Nehalem Bay; south side | -- | 4.5 | 262 |
| Nehalem ² | Nehalem River; west side | 1.1 to 1.8 | 6.1 to 6.8 | 241 |
| Mohler | Nehalem River; south side | 5.7 | 10.7 | 70 |
| Foss | Nehalem River; north side | 10.9 | 15.9 | not listed |
| Batterson | Nehalem River; north side | 12.8 | 17.8 | no pop |
| Aldervale | North Fork Nehalem River; southeast side | 3.9 | 11.6 | not listed |
| Salmonberry | Salmonberry River; south side | 0.4 | 27.7 | no pop |

¹Tidal effects extend approximately to mile 8.6 of the Nehalem River and to mile 4.7 of the North Fork Nehalem River.

²Incorporated

The estuary is about 2,820 acres in size. Reported surface areas [55,59,70] are given in Table 2; and other dimensions are included in Table 3 [55].

Nehalem Bay

Table 2. Reported surface areas of Nehalem Bay [55,59,70].

| reference | surface area (acres) | measured at | tidelands | | submerged lands | |
|-----------|-------------------------|-------------|-----------|---------|-----------------|---------|
| | | | acres | percent | acres | percent |
| [58] | 2,388 | HW | | | | |
| | 1,669 | MSL | | | | |
| | 948 | LW | | | | |
| [59] | 3,766 | 1 | 1,180 | 32 | | |
| [70] | 2,309 | MHT | 1,078 | 47 | 1,231 | 53 |
| | 1,231 | MLT | | | | |

¹Specified by Marriage as the area affected by tidal action.

Table 3. Dimensions of Nehalem Bay [55].

distance from throat to
farthest estuary shore--6.0 miles

inlet dimensions at throat (at LW):

width--375 feet

average depth--20 feet

cross-sectional area--7,501 sq ft

average lagoon depth below MSL--2 feet

The main tributary of Nehalem Bay is the Nehalem River which discharges into it from the east approximately five miles from the mouth. The river drains an area of 847 sq mi and reaches a total length of 118.6 miles, making it the longest river of the North Coast Basin. The North Fork Nehalem River, which has a length of 24.2 miles, flows into the Nehalem River at mile 2.7. From that point to the ocean, the river and bay have about two tributaries from the north and seven from the south [89,95].

The Port Commission for the area with its address and phone number is [106]:

Port of Nehalem
P.O. Box 125
Nehalem, Oregon 97131
368-5258

Nehalem Bay

Drainage Basin

Nehalem Bay drains an area of roughly 855 sq mi (estimated from [89-chart]) with an average annual fresh water yield of 2,700,000 ac-ft [53,143]. The Nehalem River, draining over 99% of the watershed (847 sq mi), yields an average of 2,662,000 ac-ft of this total with estimated extremes (between 1933 and 1958) of 4,400,000 ac-ft and 1,500,000 ac-ft. Forests cover about 775 sq mi (91%) of the watershed, and streams total over 1,350 miles in length [89].

There are climatological stations, described in Table 7, at Classic Lake and Nehalem; records from the latter are available through the OSWRB in punch card or printout form [32,28]. Precipitation in the watershed averages 85 inches along the coast, 120 inches in the northwestern sections, 50 to 60 inches to the east, and near 150 inches in the south-central portion [89].

Stream profiles for the Nehalem River system appear on page 221 in the Tillamook Basin section.

Hydraulic Description of Estuary

Tides and Currents

The estuary is about 8 miles in length [53] and is described as being fully exposed to waves at the throat [55]. Tidal effects extend to mile 8.6 of the Nehalem River and to mile 4.7 of the North Fork Nehalem River [69]. The mean tide range is 5.9 feet with a diurnal range of 7.8 feet [55] and an extreme range of 15 feet [86]. Tidal prism on mean range is 4.28×10^9 cu ft with a diurnal range of 5.66×10^9 cu ft [55].

River Discharges

There is a stream gaging station on the Nehalem River at mile 13.5 (Table 7). Records from October 1939 to October 1970 show an average discharge at this point of 2,705 cfs with extremes of 43,200 cfs (January 25, 1964) and 34 cfs (August 1967) [140]. The average monthly discharge at the mouth of the Nehalem River from 1933 to 1958 has been presented in graph form in "North Coast Basin" [51]. Estimates from this graph show December with the high average monthly discharge (8,600 cfs) and August with the low (200 cfs). Flow for all 12 months averaged 3,600 cfs.

Salinity and Classification by Mixing

Salinity measurements by Burt and McAllister in the Nehalem River were made once during each of the following months: September 1957

Nehalem Bay

and January, April, and July 1958 [12]. Of these dates, salinity intrusion was greatest on September 11, 1957 at HHW when it reached a point 13.8 miles from the ocean at a concentration of 0.1 ppt on the bottom (10 feet) with a concurrent temperature of 19.4°C. No salinity was detected at the surface. Salinity at a point 12.9 miles from the ocean was found at 1.9 ppt on the surface and 3.2 ppt on the bottom (14 feet) with concurrent temperatures of 19.6°C and 19.7°C, respectively. Measurements beyond 13.8 miles were not reported.

Burt and McAllister have classified Nehalem Bay as a partly-mixed system in January and September and as a two-layered system in April [13].

Sediments

Littoral drift in the area is to the south during the summer and to the north during most of the winter; the net drift is to the north. Material has been deposited to some degree behind the north jetty and more extensively behind the south jetty [57]. Sediments ranging from sand to clay are deposited in the estuary by its rivers and average 116,000 tons annually [85].

Water Quality Information

The DEQ operates five water surveillance stations at Nehalem Bay (Table 7) [67,68]. Records are available dating back to March 1967 with 16 sampling dates at most of the stations between then and March 1972. Data from spot water quality checks made from 1948 to 1958 in various parts of the Nehalem River are also available, as indicated in Table 7 [89,90].

Water temperature records have been kept for at least three points on the Nehalem River (Table 7) [89,90,140]. Those from the station at mile 13.5 near Foss (between February 1947 and September 1962) show the average monthly temperature ranging from 1°C (March) to 26°C (July) [138].

At the present time, there are no sewage treatment plants in the estuary area; however, bids for a pumping plant will be let in the spring of 1973. It is to be located in Nehalem and will initially serve Nehalem and Manzanita and, eventually, Wheeler, Bayside Garden, and some of the surrounding territory [104].

Nehalem Bay

Biological Information

Numbers of adult anadromous salmonids spawning in the Nehalem River are estimated as follows: fall chinook--4,000, coho--21,840, chum--200, winter steelhead--11,000, and sea-run cutthroat--8,000 [77]. Although salmon are reportedly decreasing in number [49], the comparison with other stream systems in Table B shows these figures to be fairly high.

Fish commonly taken by anglers at Nehalem Bay include shiner perch, staghorn sculpin, dungeness crab, starry flounder, and redbait perch [38]. Due to the low salinity, the most abundant clams in the estuary are softshells, found primarily north of the main channel and about 3 miles upstream from the entrance [53,155]. There are some crabs near the estuary mouth [20,53] and experimental plantings of Pacific oysters have been made [89].

The estuary is a feeding, resting, and wintering spot for waterfowl generally found in western Oregon [89], and an area of about 1.5 sq mi on the southeast portion of the estuary is a winter range for black-tailed deer and Roosevelt elk [77].

Physical Alterations

Alterations by the Army Corps of Engineers include two rubble-stone jetties and an entrance channel. The south jetty, constructed partially by the Port of Nehalem, was completed in 1915 with a total length of 4,950 feet. The northern one is 3,850 feet long and was finished in 1918. The channel goes across the ocean bar at the bay entrance and has a depth of 8 feet. It was also completed in 1918 [126,129].

Navigation on the Nehalem River is described as being possible to 8.5 miles above Wheeler or 1.0 mile upstream from Mohler [69], which would be to river mile 7 or 8 [95]. The North Fork Nehalem River has a navigable length of 5.0 miles [69].

The Division of State Lands has completed its inventory of filled lands in the Nehalem River; some of the information from it is given in Table C [69].

The FCO operates the North Nehalem River Salmon hatchery on the North Fork Nehalem River 1/4 mile downstream from the Highway 53 bridge, or approximately at mile 10.4. Between July 1, 1968 and June 3, 1969, salmon and steelhead released into Oregon waters (Nehalem River and Ten Mile Lakes) from the hatchery totaled 1,347,585 [33,54].

Nehalem Bay

Industrial and Commercial

The most important economic resource of the Nehalem basin is timber [89]; lumbering is the main industry [90]. In the area of the estuary itself, most manufacturers, listed in Table 4, deal in lumber and wood products. Tourism is also of major economic importance there, and some of

Table 4. Major Manufacturers at Nehalem Bay [71]

| Location | Name | Type of Business | Number Employed |
|----------|--|---|-----------------|
| Nehalem | Miami Shingle and Shake Co. | shakes and shingles | 17 |
| | Newberg and Scovell | logging contractors | 15 |
| | 8 manufacturers employing less than 10 | dealing mainly in lumber and wood products (mostly logging) | |

the land along the Nehalem River and its tributaries is used for agriculture, dairy farming, and cattle raising [69,104].

Commercial fish landings, generally very limited, totaled less than 1,400 pounds of coho, clams, and groundfish in 1971. A breakdown is given in Table 5, and these figures are also included in Table D of the introduction

Table 5. Commercial Harvest of Food Fish Received at Nehalem Bay, 1971 [34].

| Species | Harvest (pounds round weight) | Fishermen value |
|-------------|----------------------------------|--------------------|
| Clams | 589 | |
| Coho | 524 | NOT |
| Ground Fish | 262 | GIVEN |

Nehalem Bay

for comparison with landings received at other ports. Statistics showing the value of the landings to fishermen, given here in Table E, were not included for Nehalem, probably because they were too limited to be of significant value [34]. For example, 1970 clam landings reported by other sources weighed only 258 pounds with a value to fishermen of \$33 [49,118].

Recreational

Angling and clamming are popular; annual harvest data for non-game bay fish and clams are given in Table 6. Salmon are taken mainly between the "bar" and Foley Creek (river mile 7.5) by trolling. Chinook enter

Table 6. Estimated Annual Harvest Data for Sport Fishing at Nehalem Bay, 1970 [77].

| Species | area fished | annual harvest (total number) | effort (angler- or digger-days) |
|----------------------|----------------|----------------------------------|---------------------------------------|
| Non-game bay fish | Estuary | 12,00 | 5,000 |
| Clams | Estuary | 27,000 | 900 |

the river in August and run until late September. From mid-August to mid-October coho are present, and following the first Fall rains, there is usually a nice run of jack salmon (two-year old bucks) [58]. Other species commonly caught in the bay (as determined by the FCO study between March and October 1971) include shiner perch, staghorn sculpin, and dungeness crab by shore angling and dungeness crab and relatively few starry flounder and redbtail perch by boat angling [38].

Nehalem Bay State Park is located on the north side of the estuary. Attendance during 1970, which was the first year of record, was 9,403 camper nights. Of those nights, less than 0.5%, or 47, have been estimated as being spent on the estuary itself [52,82,83].

Nehalem Bay

Table 7. Surveillance stations at Nehalem Bay.

| type of station | name and/or identifying number | approximate location | drainage area (sq mi) | period of record | references |
|------------------------|-------------------------------------|---|-----------------------|----------------------------------|-------------------------|
| climatological | Classic Lake | 1 mile north of Nehalem Bay; elevation--60 feet | | 1922-1926 | [89,90] |
| | Nehalem; USGS #5969 | 1 mile north of Nehalem Bay | | 1894*(1967) | [90,92,124,143] |
| stream gaging | Nehalem River near Foss; USGS #3010 | Nehalem River; mile 13.5 | 667 | 10/39-(1970) | [89,90,98] ² |
| DEQ water surveillance | #1 | Nehalem Bay; 1/4 mile above Highway 101 bridge next to City of Nehalem; west side of channel | | 3/67-(3/72) (16 measurements) | [67,68] ³ |
| | #2 | Nehalem Bay; channel, 200 yards west of Tyee Grill at Wheeler | | 3/67-(3/72) (16 measurements) | " |
| | #3 | Nehalem Bay; channel, 150 yards west of Paradise Cove | | 3/67-(3/72) (16 measurements) | " |
| | #4 | Nehalem Bay; channel, 175 yards west of Easton's Moorage | | 3/67-3/72 (16 measurements) | " |
| | #5 | Nehalem Bay; channel, 250 yards west of cable crossing entry to Nehalem Bay near large yellow house | | 3/67-3/72 (15 measurements) | " |
| water quality | Nehalem River from ocean to Nehalem | | | 1948-1958 (spot observations) | [89,90] |
| | Nehalem River | Nehalem River; mile 9.3 | | | [89,90] |
| water temperature | Nehalem River from ocean to Nehalem | | | 1948-1958 (spot observations) | [89,90] |
| | | Nehalem River; mile 9.3 | | 8/60-(1971) (monthly) | [89,90] |
| | Nehalem River near Foss; USGS #3010 | Nehalem River; mile 13.5 | 667 | 2/47-(9/62) | [140] |

¹ Precipitation data available in punch card or printout form through the OSWRB.

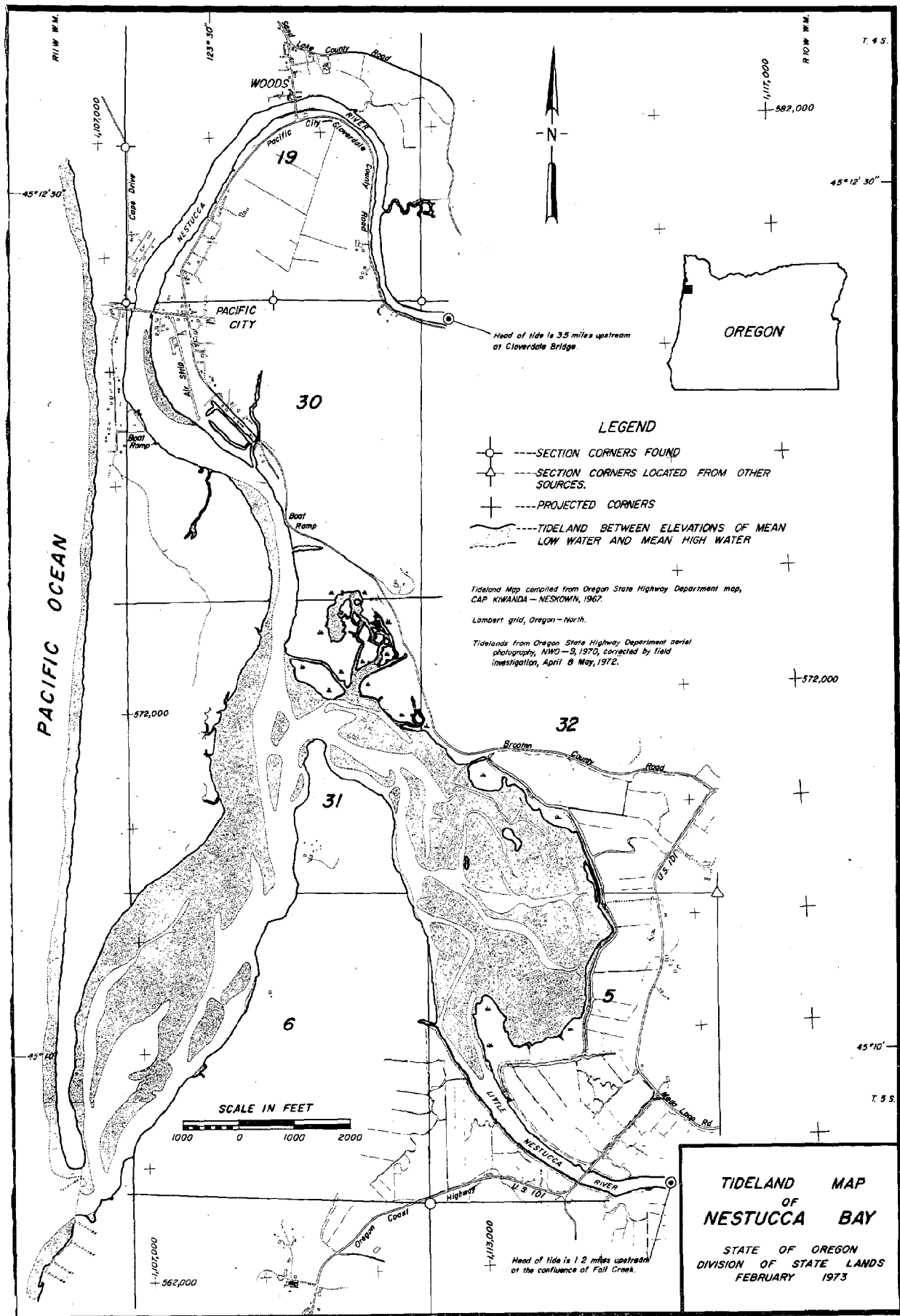
² Monthly and water-year runoff records have been compiled and are available in punch card or printout form through the OSWRB.

³ Data available in punch card or printout form through the DEQ.

() This is the most recent record date found and is not necessarily the last.

* Period of record is not continuous.

NESTUCCA BAY



NESTUCCA BAY

General Description of Estuary and Drainage Basin

Estuary

Nestucca Bay lies approximately 75 miles south of the Columbia River mouth and is the fourth smallest estuary of those included here (Table A). There are no towns on the bay itself, and none in the area are incorporated. Pacific City, with a 1970 population of 400, is the largest. This and other population centers there are listed in Table 1.

Table 1. Population centers at Nestucca Bay¹ [89,95,111].

| name | general location | river mile location | approximate distance from estuary mouth (miles) | 1970 population |
|--------------|-----------------------------------|-----------------------------|---|-----------------|
| Oreton | 2 miles south of Nestucca Bay | -- | -- | rural |
| Pacific City | Nestucca River; east side | 1.5 | 3.5 | 400 |
| Woods | Nestucca River; north side | 2.4 | 4.4 | 95 |
| Cloverdale | Nestucca River; south side | 7.0 | 9.0 | no pop |
| Meda | Little Nestucca River; south side | 2.5 (0.5 mile to the south) | -- | rural |
| Dolph | Little Nestucca River; north side | 10.9 | 13.9 | not listed |
| Hebo | Three Rivers | 0.9 | 12.7 | 200 |

¹Tidal effects extend approximately to mile 7.0 of the Nestucca River (the Cloverdale Bridge) and to mile 3.1 of the Little Nestucca River (0.8 mile above the Meda Loop Bridge).

The estuary is approximately 1,060 acres in size--surface areas reported by Johnson [55], Marriage [59], and the Division of State Lands [70] are given in Table 2 which also shows that over 50% of the bay is tidelands, although at one time it was a much larger estuary [53,70,155].

Major tributaries are the Nestucca River from the north and the Little Nestucca River from the south. There are two smaller tributaries discharging into the bay from the east, and Upton Slough empties into the Little Nestucca River just before the latter flows in the bay [89]. The Nestucca and Little Nestucca Rivers have their zero miles at their points of discharge into the bay, or roughly 2 and 3 miles, respectively, from the ocean [95,89-chart]. The Nestucca River is 52.9 miles long, drains 259 sq mi [95], and had an estimated average annual fresh water yield of 1,114,900 ac-ft between 1933 and 1958 [89]. A major tributary of the Nestucca River is Three Rivers, which has a length of 12.7 miles and discharges into the Nestucca River at mile 9.8. The Little Nestucca River is 19.5 miles long and drains 59 sq mi [95].

Nestucca Bay

Table 2. Reported surface areas of Nestucca Bay [55,59,70].

| reference | surface area (acres) | measured at | tidelands | | submerged lands | |
|-----------|-------------------------|-------------|-----------|---------|-----------------|---------|
| | | | acres | percent | acres | percent |
| [6] | 1,022 | HW | | | | |
| [63] | 1,149 | 1 | | | | |
| [117] | 1,000 422 | MHT MLT | 578 | 58 | 422 | 42 |

¹Specified by Marriage as the area affected by tidal action.

Drainage Basin

The estuary has a drainage area of about 322 sq mi (estimated from [89-chart]) consisting of sparsely settled, rough, mountainous, forested land [49]. It yields an average of 1,600,000 ac-ft of fresh water per year [85] and receives average annual precipitation ranging from 85 inches in the coastal areas to 110 inches in the central watershed [89]. There is a climatological station on the Nestucca River near mile 7 (Table 7) for which records are available back to 1940 [89,90,92].

Stream profiles for the Nestucca River system appear on page 221 in the Tillamook Basin section.

Hydraulic Description of Estuary

Tides and Currents

The bay is described as being fully exposed to waves at the throat. It has a mean tide range of 5.8 feet with a diurnal range of 7.6 feet [55].

Tidal effects, as reported by the Division of State Lands, extend to the Cloverdale Bridge (mile 7.0) on the Nestucca River and to 0.8 mile above the Meda Loop Bridge (mile 2.3) on the Little Nestucca River [69,95].

River Discharges

There are stream gaging stations on the Nestucca River at miles 13.5 and 49.3 (Table 7). Between 1964 and 1970 the average discharge at mile 13.5 was 1,042 cfs with extremes of 24,000 cfs (January 28, 1965) and 32 cfs (September 14, 1967). At mile 49.3 river flow between 1960

Nestucca Bay

and 1970 averaged 32.6 cfs with extremes of 876 cfs (December 22, 1964) and 0.87 cfs (July 17, 1968) [140]. Normal flow at the mouth of the Nestucca River is estimated at 1,540 cfs [85].

Salinity and Classification by Mixing

Giger [39] provides salinities with depth and length for high and low tides during winter (1969) and summer (1969) conditions. Salinity intrusion extended to approximately 4-5 miles from the mouth during the summer period. During the winter, saline water was located only within approximately the first two miles from the mouth with very low salinities occurring during low tide periods. Tidal variations of salinity appeared significant during both the winter and summer periods.

Sediments

Littoral drift in the area varies, being mainly to the south during the summer and to the north during the winter. Net movement, as indicated by the formation of a spit pointing south, is probably to the south [57].

The rivers deposit about 54,000 tons of sediments (ranging from sands to clays) into the bay annually, resulting in a definite reduction in the size of the estuary [57,85]. Sand dunes at the mouth shift enough to cause severe flooding of the estuary [69].

Water Quality Information

The DEQ operates six water quality stations in Nestucca Bay. Data is now available for the 1970 through 1971 period (3 measurements) [68]. Locations are given in Table 7.

There are USGS water temperature stations, also listed in Table 7, on the Nestucca River at mile 13.5 and on Cedar Creek near Hebo. (Cedar Creek discharges into Three Rivers near mile 2.) [138,141] Records of the daily temperature range for 1964 to 1968 from the Nestucca River station show extremes of 3°C (December 1964) and 24°C (May 1967). The greatest one-day range at this location during the 1968 water year was 4°C. This occurred on several days during July and August with temperatures as low as 15°C and as high as 21°C [141]. Records from the Cedar Creek station were kept from 1943 to 1962 and show the average temperature for each month. January 1957 had the lowest average temperature (1°C) and July 1949 had the highest (17°C) [138].

There are some water quality problems from increased domestic sewage and from siltation from logging runoff [155].

Nestucca Bay

Biological Information

The Nestucca River provides spawning grounds for relatively high numbers of fall chinook and winter and summer steelhead (Table B). Estimated numbers of these and other anadromous salmonids (coho, chum, spring chinook, and sea-run cutthroat) spawning in the Nestucca and Little Nestucca Rivers are given in Table 3 [77].

Table 3. Estimated numbers of adult anadromous salmonids spawning in the Nestucca and Little Nestucca Rivers [77].

| stream | chinook | | coho | chum | steelhead | | sea-run cutthroat |
|--------------------------|---------|--------|--------|-------|-----------|--------|----------------------|
| | spring | fall | | | winter | summer | |
| Nestucca River | 1,800 | 19,350 | 17,500 | 1,000 | 36,000 | 5,500 | 5,000 |
| Little Nestucca River | 90 | 1,215 | 1,080 | 1,000 | 1,290 | 100 | 800 |
| totals | 1,890 | 20,565 | 18,580 | 2,000 | 37,290 | 5,600 | 5,800 |

Due to the low salinity of Nestucca Bay, the only clams supported there are softshell varieties. Salmon, cutthroat trout, flounder, perch, staghorn sculpin, and dungeness crab are taken by sportsmen as described under "Estuary Uses" [38,77,89,155].

The bay is fairly important as a wintering area for water fowl [155].

Physical Alterations

Jetties have not been constructed, and dredging by the Corps of Engineers has not occurred. Navigation is possible to mile 6.0 of the Nestucca River and to mile 1.6 of the Little Nestucca River [69].

The Division of State Lands has completed its inventory of filled lands in the Nestucca River, and some information from the report is given in Table C [69].

The Cedar Creek hatchery, located near Hebo at mile 2 of Three Rivers, is operated by the OSGC. Three Rivers discharges into the Nestucca River at mile 9.8, so the hatchery is about 12 miles from the bay. Releases of anadromous fish from the hatchery during 1970 totaled 712,404 and consisted of 49,604 summer steelhead, 602,164 winter steelhead, and 60,636 spring chinook.

Nestucca Bay

Estuary Uses

Industrial and Commercial

Most of the industry in the basin is connected with processing of timber or with agricultural products [89]. In the estuary area itself, manufacturing companies, listed in Table 4, are small and deal mainly in lumber [71].

Table 4. Major Manufacturers at Nestucca Bay [71].

| Location | Name | Type of Business | Number Employed |
|--------------|----------------------------|----------------------------|-----------------|
| Pacific City | Kiwanda Fish Co. | canned and frozen seafoods | 2 |
| | Pacific City Boat works | dories | 1 |
| Cloverdale | Anderson Log Co. | logging | 4 |
| | Kimber Log and Lumber Co. | lumber | 2 |
| Hebo | Noble and Bittner Plug Co. | plugs and lumber and chips | 19 |
| | Wm. H. Balmer Logging Co. | fir/spruce/hemlock | 7 |

There is some farming around the bay and along the Nestucca River where the main crops are hay and pasture for livestock [89], and commercial and sport fishing also provide some income [34]. Although there are no commercial landings from the estuary, those received at Pacific City during 1971 had a value to fishermen of \$265,000 and totaled 864,381 pounds, consisting primarily of coho with some groundfish, chinook, and albacore tuna. A breakdown is given in Table 5, and a comparison with landings received at other ports can be made from Tables D and E [34].

Recreational

Salmon and steelhead and cutthroat trout fishing in the Nestucca and Little Nestucca Rivers is outstanding--some consider the Nestucca as the best fishing stream of the state [58,69]. June and July provide good chinook fishing in the tidewater areas of both rivers with the main fall run beginning around the first of August and lasting through September. Coho enter the Nestucca River just after mid September and usually continue until the beginning of December. Numerous coho and some chinook are taken by deep sea fishing out of Pacific City from late June to the end of summer [58]. Species other than salmon and trout most commonly landed from the bay by sportsmen, as determined in the FCO study between March and October 1971, include staghorn sculpin and shiner perch by shore

Nestucca Bay

angling; dungeness crab and relatively few striped seaperch by boat angling; and softshell clams and relatively few "shrimp" (ghost and/or mud) by clamming [38]. Estimated sports catches are shown in Table 6 [77,89].

The bay is also used as a hunting area for waterfowl [155].

Table 5. Commercial Harvest of Food Fish Received at Pacific City, 1971 [34].

| Species | Harvest (pounds round weight) | Fishermen value |
|------------------|-------------------------------------|--------------------|
| Coho | 792,773 | \$248,000 |
| Groundfish | 45,030 | 4,000 |
| Chinook | 18,347 | 10,000 |
| Albacore Tuna | 7,924 | 3,000 |
| Crabs | 142 | — |
| Pinks | 17 | — |
| Miscellaneous(1) | 148 | — |
| Totals | 864,381 | \$265,000 |

(1) Sand shrimp, crawfish, and eel.

Table 6. Estimated Annual Harvest Data for Sport Fishing at Nestucca Bay, 1970 [77].

| Species | area fished | annual harvest (total number) | effort (angler- or digger-days) |
|----------------------|----------------|----------------------------------|---------------------------------------|
| Non-game bay fish | Estuary | 3,000 | 400 |
| Clams | Estuary | 12,000 | 400 |

Nestucca Bay

Table 7. Surveillance stations at Nestucca Bay.

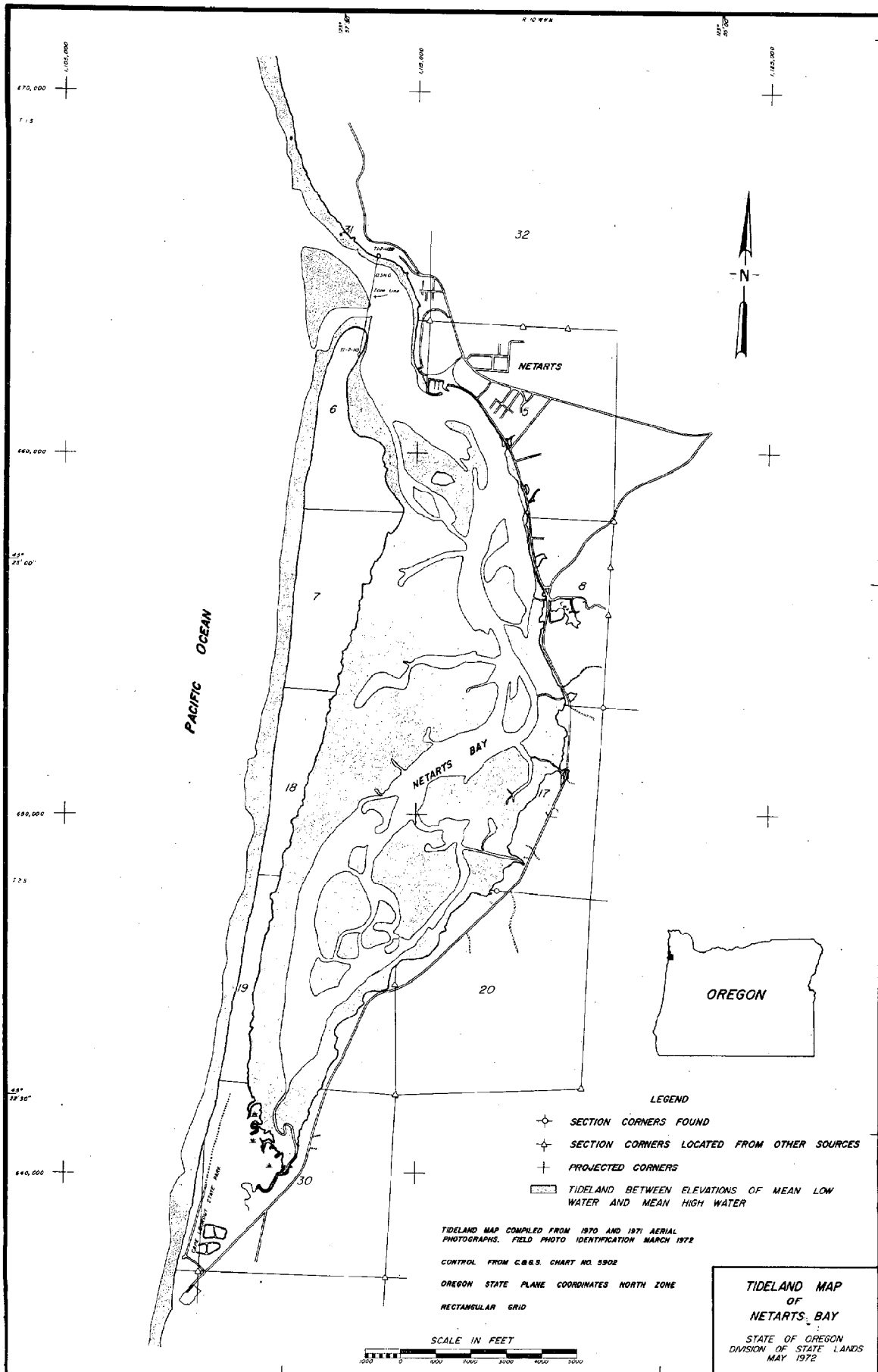
| type of station | name and/or identifying number | approximate location | drainage area (sq mi) | period of record | references |
|------------------------|---|---|-----------------------|--|-------------------------|
| climatological | Cloverdale 1 NW: USGS #1682 | Nestucca River; mile 7; elevation--20 feet | | 1940-(1960) | [89,90,92] ¹ |
| stream gaging | Nestucca River near Beaver; USGS #3036 | Nestucca River; mile 13.5 | 180 | 10/64-(1970) | [98,140] ² |
| | Nestucca River below Powder Creek near Blaine; USGS #3035 | Nestucca River; mile 29 | 91.2 | 10/28-9/44 | [98] ² |
| | Nestucca River near Fairdale; USGS #3029 | Nestucca River; mile 49.3 | 6.18 | 6/60-(1970) | [98,140] ² |
| DEQ water surveillance | #1 | Nestucca Bay; 1.5 miles upstream from mouth | | data not yet available although samplings have been made | [67] |
| | #2 | Nestucca Bay; bay inlet of Little Nestucca River | | " | " |
| | #3 | Nestucca Bay; 1.5 miles below Pacific City bridge | | " | " |
| | #4 | Nestucca Bay; Pacific City bridge | | " | " |
| | #5 | Nestucca Bay; Woods City bridge | | " | " |
| | #6 | Nestucca Bay; 2.5 miles upstream from Woods City bridge | | " | " |
| water temperature | Nestucca River near Beaver | Nestucca River; mile 13.5 | 180 | 10/64-(9/68) | [141] |
| | Cedar Creek near Hebo | | | 2/43-(1962) | [138] |

¹Precipitation data available in punch card or printout form through the OSWRB.

²Monthly and water-year runoff records have been compiled and are available in punch card or printout form through the OSWRB.

() This is the most recent record date found and is not necessarily the last.

NETARTS BAY



NETARTS BAY

General Description of Estuary and Drainage Basin

Estuary

Netarts Bay is located about 60 miles south of the Columbia River mouth. As the sixth largest of the estuaries included in this report (Table A), it is of relative medium size. The only three towns in the area (with their 1970 populations) are Netarts (900), Wilson Beach (30), and Oceanside (160), none of which are incorporated. Both Netarts and Wilson Beach lie on the north side of the bay--Netarts at the mouth, and Wilson Beach about 1 mile to the east. Oceanside is not actually on the estuary, but a few miles to the north on the coast [89,111]. An area of about 150 acres near Whiskey Creek, a tributary from the east and near the center of the bay, is used as the OSU estuary research area [155].

The estuary covers roughly 2,300 acres. As can be seen from reported surface areas and tidelands acres presented in Table 1, tidelands are fairly extensive, comprising from 65% to 90% of the total area [53,55,59,70], and its only tributaries are 12 small creeks 1 or 2 miles in length [see 89-chart]. Hydrographic Survey map No. 8372 by the U.S. Coast and Geodetic Survey describes the bay in 1957. The meander pattern of channels within the Bay, however, has changed since 1957 [41]. Contours within the bay from aerial photographs have been prepared for August 2, 1970 [41]. The volume for mean high water appears to have decreased by 10 percent from 1957 to 1969[41].

Table 1. Reported surface areas of Netarts Bay [55,59,70].

| reference | surface area (acres) | measured at | tidelands | | submerged lands | |
|-----------|-------------------------|-------------|-----------|---------|-----------------|---------|
| | | | acres | percent | acres | percent |
| [6] | 2,179 | HW | 2,160 | 90 | | |
| [63] | 2,406 | 1 | | | | |
| [117] | 2,325 812 | MHT MLT | 1,513 | 65 | 812 | 35 |

¹Specified by Marriage as the area affected by tidal action.

Drainage Basin

The bay drains an area of only 14 square miles [89-chart], which yields 42,000 ac-ft of fresh water annually, based on an estimated average annual yield for the North Coast Basin of 3,000 ac-ft/sq mi. Precipitation averages between 100 and 110 inches annually [89].

Netarts Bay

Hydraulic Description of Estuary

Tides and Currents

The bay is partially exposed to waves at the throat. The mean tide range is 5.7 feet with a diurnal range of 7.5 feet [55]. Measurements at the entrance show MHHW at 6.6 feet, MHW at 6.0 feet, MTL at 3.5 feet, MLLW at 0.0 feet, and extreme LW at -3.0 feet [130-#5902].

Waters leaving the mouth of Netarts Bay during the summer move primarily south toward Cape Lookout and along the beach littoral zone (surf zone) [41].

A study of tidal exchanges and mixing within Netarts Bay during the summer of 1969 is provided by Glanzman, Glenne and Burgess [41].

River Discharges

No records of streamflow rates of any of the Netarts Bay tributaries were found.

Salinity and Classification by Mixing

Due to the lack of any major tributaries, the estuary is quite high in salinity. Measurements by Burt and McAllister were taken in the bay at HHW once during January 1958 and once during July 1958 [12]. The sampling made farthest from the mouth was at 5.5 miles (probably the southernmost tip of the bay) on January 5, 1958. At this point, salinity was still easily detected at a concentration of 13.9 ppt on the surface with a concurrent temperature of 6.8°C.

Burt and McAllister also classified Netarts on the basis of mixing characteristics and found it to be a well-mixed system during January and April [13]. Based on summer 1969 measurements, Glanzman, Glenne and Burgess also consider the bay to be vertically well mixed [41].

Sediments

Littoral drift varies, but is predominantly northward during the winter and southward during the summer. As already mentioned, the bay is fairly stable since it has no major tributaries. In fact, sediments transported to it are estimated to average only 2,250 tons annually [57,85].

Netarts Bay

Water Quality Information

The DEQ operates six water surveillance stations in Netarts Bay (Table 5) [67,68]. Records are available for about 34 samplings from each of the stations between May 1960 and March 1972, but with BOD, DO, conductivity, and turbidity information lacking before 1967. Some pollution was occurring from septic tank seepage near the town of Netarts, but correction of the problem had been planned as of 1970 (publication date) [155].

Biological Information

Of the 12 Netarts Bay tributaries, the OSGC reports that eight are used by anadromous fish. Estimates of the actual number of salmonids spawning there were not given [77].

The high salinity provides good conditions for a variety of clams. Gaper, cockle, butter, and some razor clams are located in the northern half of the bay toward the mouth, and remnant populations of geoducks and thinshelled little neck clams are also present. The southern section is apparently low enough in salinity to support some softshells [53,155].

Netarts is the only bay of the North Coast Basin where native oysters can still be found, although as a remnant population only. Pacific oysters are cultivated in the bay, as described under "Estuary Uses." Other species (all of recreational or commercial interest) supported there are salmon, perch, flounder, crab, kelp greenling, and black rockfish [38,89,155].

Waterfowl, including black brant, use the bay as a feeding, resting, and wintering spot [89,155], and an area of about 3 sq mi to the east of the estuary is considered a big game winter range, mainly for black-tailed deer and Roosevelt elk [77].

Physical Alterations

Corps of Engineers records show that jetties have not been constructed and dredging has not taken place [55].

Netarts Bay

Estuary Uses

Industrial and Commercial

Little information on industrial use of the Netarts Bay area was found, except that manufacturing companies are lacking completely [71] and commercial fishing is limited, with landings consisting of Pacific oysters, cultivated on about 300 of the bay's tideland acres [53,89,155], and a few crabs and clams, as shown in Table 2 [34,77,118]. Other species such as salmon, trout, sturgeon, shad, bass, shrimp, and tuna which are received at many of the other ports apparently are not received at Netarts (Tables D and E).

Table 2. Commercial Harvest of Clams, Crabs, and Oysters From Netarts Bay [[34,77,118]

| Species | 1970 | | 1971 | |
|---------|---------------|-----------------|---------------|-----------------|
| | pounds landed | fishermen value | pounds landed | fishermen value |
| Clams | 2,210 | \$283 | 1,589 | |
| Crabs | 14,280 | | 21,761 | \$5,000 |
| Oysters | 122 | \$119 | | |

Recreational

Recreationally, clam digging at Netarts is very popular. Of the North Coast Basin estuaries, more days are estimated as being spent clamming there than at any other, although the harvest from Tillamook is about nine times as great. The estuary and its tributaries are also popular for salmon and steelhead angling [77]. Other species most commonly taken from the estuary (as determined in the FCO study from March to October 1971) are kelp greenling, black rockfish, and relatively few striped seaperch by shore angling; dungeness crab, relatively few red rock crab, and very few striped seaperch by boat angling; and gaper, cockle, and butter clams by clamming [38]. Estimated annual harvest data for non-game bay fish angling and for clamming in the estuary are shown in Table 3 [77].

Netarts Bay

Cape Lookout, a state park bordering the south side of the estuary, provides facilities for day visitors and for campers. Attendance figures have been dropping since 1967 and are included for 1966, 1967, and 1970 in Table 4 [82,83,52].

Table 3. Estimated Annual Harvest Data for Sport Fishing at Netarts Bay, 1970 [77].

| Species | area fished | annual harvest (total number) | effort (angler- or digger-days) |
|-------------------|-------------|-------------------------------|---------------------------------|
| Non-game bay fish | Estuary | 5,000 | 1,000 |
| Clams | Estuary | 60,000 | 20,000 |

Table 4. Cape Lookout State Park Annual Attendance, 1966, 1967, and 1970 [82,83].

| Park Users | 1966 attendance | | 1967 attendance | | 1970 attendance | |
|---------------|-----------------|------------|-----------------|------------|-----------------|------------|
| | total park | estuary(1) | total park | estuary(1) | total park | estuary(1) |
| day visitors | 155,388 | < 777 | 222,208 | < 1,111 | 85,216 | < 426 |
| camper nights | 107,903 | < 540 | 114,551 | < 573 | 97,096 | < 485 |

¹Actual use of the estuary portion of the park estimated to be less than 0.5% of the total attendance [52].

Netarts Bay

Table 5. DEQ water surveillance stations at Netarts Bay¹ [67,68].

| identifying number | location | period of record | number of measurements |
|--------------------|--|------------------|------------------------|
| #1 | channel, 0.4 mile northwest of Tillamook County boat launching site | 5/60-(3/72) | 34 |
| #2 | channel, opposite boat ramp mouth at pilings | " | " |
| #3 | channel, 0.4 mile south of Wilson Beach | " | " |
| #4 | channel, 600 yards southwest of sample station #3 | " | " |
| #5 | channel, 300 yards west of highway junction (Cape Lookout-Netarts Bay Highway) | " | " |
| #6 | channel, 0.6 mile southwest of sample station #5 | " | 33 |

¹Records are not complete before 1967.

PISTOL RIVER



PISTOL RIVER

General Description of Estuary and Drainage Basin

Estuary

The Pistol River Estuary lies 274 miles south of the Columbia River mouth. It ranks as one of the smallest in size in terms of surface area. Population in the area is largely rural, the small town of Pistol River, Oregon being north of the river and just east of the Oregon Coast Highway (U.S. 101) at river mile 1.0. Population figures were not listed for Pistol River, Oregon [9,96,111,134].

The HW surface area of the estuary as estimated from 1973 EROS Data Center aerial photographs is 230 acres [135].

The average annual yield of the Pistol River at its mouth was 360,000 ac-ft for the period of 1930 to 1961. The minimum annual yield was 210,000 ac-ft. The Pistol River source is at river mile 21.8, elevation 3,200 feet [93,96].

Drainage Basin

The Pistol River drains a total basin area of 106 sq. miles. The average yearly freshwater yield is 360,000 ac-ft which equals an average annual precipitation of 64 inches over the basin [93].

The Pistol River Basin consists primarily of woodlands (92.1%; 62,998 acres), cropland (51.0%; 392 acres), and pasture (6.5%; 4,460 acres). As of January, 1963 the Pistol River has no existing storage ponds or reservoirs and no studies for potential reservoir sites.

The average annual precipitation ranges from 80 inches at the mouth of the Pistol River to 115 inches in the upper reaches.

The closest climatological station is the Gold Beach R.S. station, 10 miles to the north of the Pistol River Estuary, which has recorded temperature and precipitation data from 1889-1891, 1903-1913, 1915-1918, and 1927 to the present. (See Table 5) [93,143].

The Pistol River has a length of 21.8 miles. The elevation drop from the source to the mouth is 3,200 feet which produces an average gradient of 147 feet per mile [93].

Pistol River stream profile appears on page 43 in the Chetco River Basin section.

PISTOL RIVER

Hydraulic Description of Estuary

Tides and Currents

According to the U.S. Geological Survey the average range of the tide is approximately 5 feet [144].

It appears that the mouth of the Pistol River Estuary may migrate several hundred yards and change its position periodically due to the sand bar and coastline characteristics at the mouth. During the summer months the sand bar prevents saline water from entering the estuary except during periods of extremely high tide.

River Discharges

Streamflow records are available from the USGS stream gaging station on the Pistol River. The station is discontinued, but spot observations are available for the years 1935, 1938, and 1949-52. Streamflow averages and extremes appear in Table 1 [148].

Table 1. Stream Gaging Data [148].

| Stream | Location | Drainage (sq.mi.) | Complete water years of record | Flowrate (cfs) | | |
|-----------------|-----------------------|----------------------|--------------------------------------|-------------------|------|------|
| | | | | max. | min. | mean |
| Pistol River | T38S, R14W Sec. 21 | --- | --- | 48.0 | 8.2 | 17.4 |

Salinity and Classification by Mixing

Salinity profiles as a function of depth and distance from the mouth of the river are presented in Table 2. Data was taken on August 23, 1973 during a high tide of +4.5 feet [87].

Sediments

Between Port Orford and Brookings, the area is mountainous and rocky, with steep cliffs and sand beaches.

According to the National Shoreline Study by the U.S. Army Corps of Engineers (Aug., 1971), the shoreline north of the Pistol River Estuary to Cape Sebastian is experiencing non-critical erosion, while the shoreline south of the estuary to Crook Point is experiencing no erosion. From Crook Point to within 5 miles of Brookings the shoreline is experiencing non-critical erosion while the remainder of the shoreline to the Chetco River Estuary is experiencing critical erosion [125].

The generalized sediment yield for the Pistol River Basin is 0.1 to 0.2 ac-ft per sq. mile per year [23].

PISTOL RIVER

Table 2. Salinity Values for
the Pistol River Estuary*
Aug. 23, 1973 [87].

| Station | Distance from mouth (mi) | Salinity % | | Depth (ft.) |
|---------|-----------------------------------|------------|--------|----------------|
| | | top | bottom | |
| 1 | 0.1 | 0.2 | 0.2 | 3 |
| 2 | 0.3 | 0.2 | 0.2 | 8 |
| 3 | 0.4 | 0.2 | 0.2 | 8 |
| 4 | 0.7 | 0.2 | 0.2 | 6 |

* The Pistol River mouth was completely closed off by sand bars through which river flows seeped to the ocean. No saline water entered the estuary except for extremely high tides.

Water Quality Information

Miscellaneous flow and temperature measurements for the basin were made by the Oregon State Game Commission. Temperature ranges from these sources are presented in Table 3 [78].

Table 3. Temperature Extremes for
the Pistol River Drainage Basin [78].

| Point of measurement | Period of record | Observed Temperature Extremes (F°) | | |
|--|----------------------|---------------------------------------|------|---------------------|
| | | max. | min. | type of observation |
| Pistol River 1.8 mi. above Crook Creek | 4-9-69 to 7-23-69 | 71 | 49 | spot |
| Crook Creek 100 yds. above mouth | 4-9-69 to 7-23-69 | -- | 54 | spot |
| Deep Creek 100 yds. above mouth | 4-9-69 to 7-23-69 | 56 | 50 | spot |

DEQ water quality stations are listed in Table 5.

PISTOL RIVER

Biological Information

Estimates of the number of adult anadromous salmonids spawning in the Pistol River system are as follows: spring chinook--0, fall chinook--500, coho--50, steelhead--1,200, sea-run cutthroat--4,000.

Dace, cottids, red-sided shiners, sticklebacks, lamprey, and suckers are the known rough fish species in the stream systems of the South Coast Basin [78].

The most important factor limiting fish production in the South Coast Basin is summer water supply. The Pistol River contains extensive porous gravel beds through which summer flows frequently sub-out, resulting in considerable fish loss. Summer flows which substantially sub-out can also be excessively warm [78].

The Pistol River system has 6 streams used by adult anadromous salmonids, 3 of which have minimum flow recommendations established and 1 protected by the State Water Resources Board [78].

Table 4 refers to the estimated sport harvest in the Pistol River system.

Table 4. Estimated Annual Harvest, Angler Days, and Gross Expenditures for Angling in the Pistol River System [78].

| Fish | Harvest | Angler days | Gross Expenditures |
|-----------|---------|-------------|--------------------|
| Salmon* | 300 | 1,200 | \$22,200 |
| Steelhead | 350 | 1,400 | 25,900 |
| Sea-run | 475 | <u>250</u> | <u>4,625</u> |
| TOTALS | | 2,850 | \$52,725 |

* Includes jack salmon

Figure 1 is a periodicity chart showing when adult spawning anadromous fish are present in the Pistol River system.

A general description of big game, upland game, waterfowl, and furbearers of the basin is given in the Sixes River section on Biological Information.

PISTOL RIVER

Figure 1. Periodicity Chart for Adult
Spawning Anadromous Fish in the Pistol River System [78].

Chinook Salmon *****

Coho Salmon -----

Steelhead and
Cutthroat trout ::::::::::::::

| Stream | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | April | May |
|--------------|-------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Pistol River | ***** | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: |
| Crook Creek | | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: |
| Deep Creek | | ***** | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: |

Physical Alterations

The only physical alteration near the estuary is the Oregon Coast Highway Bridge (U.S. 101) at river mile 1.2 [96].

Estuary Uses

Industrial and Commercial

Irrigation and gravel removal are the only industrial and commercial uses for the Pistol River. The average annual yield of the Pistol River is 360,000 ac-ft. The legal annual depletion is 100 ac-ft with the estimated actual annual consumption being 30 ac-ft. Surface water rights include 0.18 cfs for domestic and irrigation purposes.

Chromite, nickel, and quicksilver are mined in the watershed [93].

PISTOL RIVER

Recreation

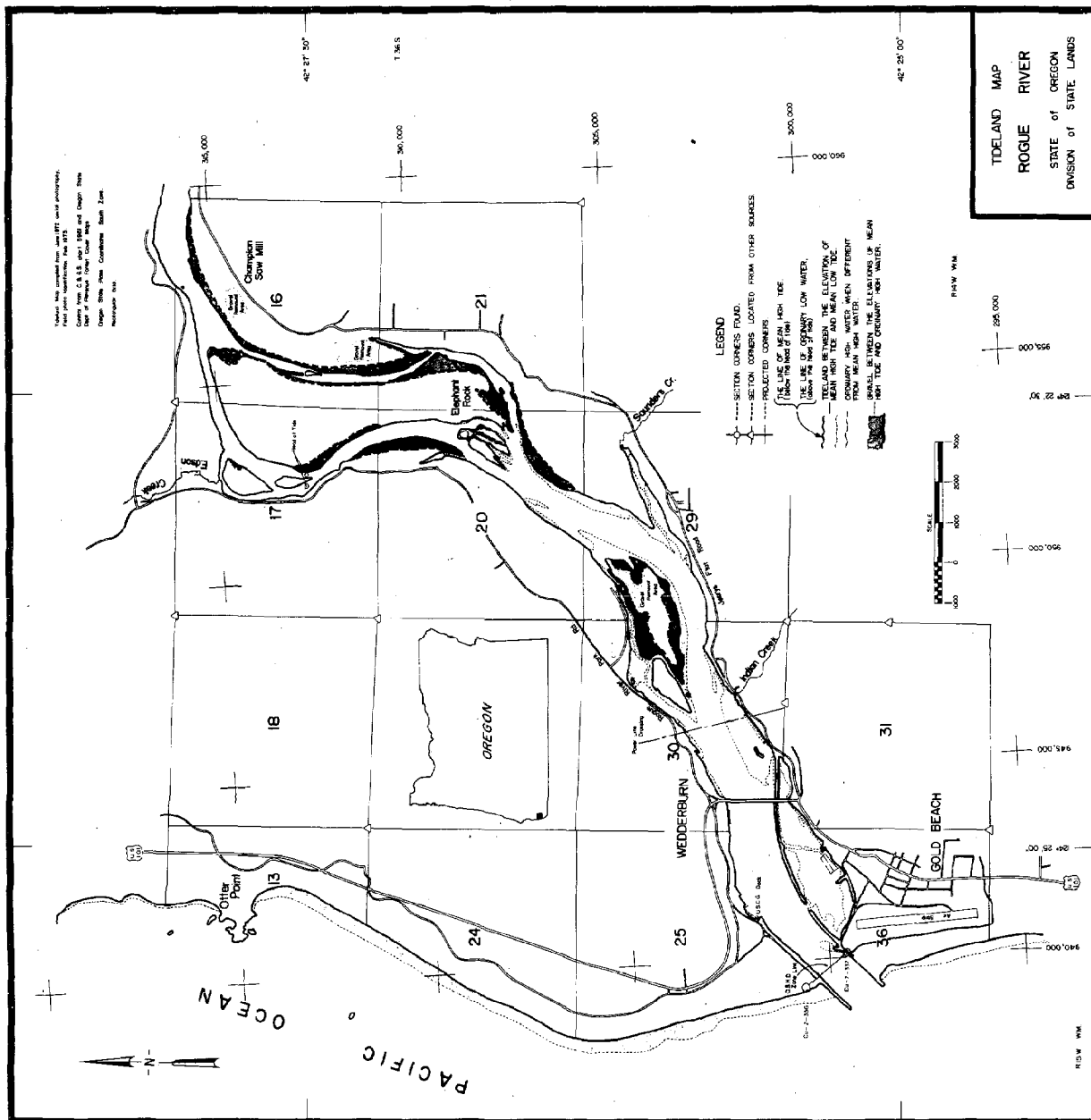
The principal attraction of the basin is the Pacific Ocean which is easily accessible from the Oregon Coast Highway (U.S. 101) at the Pistol River Estuary. A small state park is located south of the estuary between the highway and the ocean beaches.

Parts of the Pistol River flow through the Siskiyou National Forest. Several streams in the basin have outstanding aesthetic value and make a significant contribution simply because they maintain attractive flows, have little stream-side development, and possess watersheds that have not been extensively logged. The Pistol River above Deep Creek was selected by the Oregon State Game Commission as a stream which should be managed for its aesthetic value [78,93].

Table 5. Surveillance Stations near the
Pistol River Estuary

| Type of station | Name and/ or identifying number | Approximate location | Drainage area (sq.mi.) | Period of record | Reference |
|-----------------|---|--------------------------------------|------------------------|---|-----------|
| Climatological | Gold Beach R.S. (Formerly Ellensber ; Wedderburn) | T37S, R14W Sec. 6 | --- | 1889-1891, 1903-1913, 1915-1918, 1927-present | [93] |
| Water Quality | Pistol River 4 mi. above | T38S, R14W Sec. 22 river mile 4.5 | --- | | [152] |
| Stream Gaging | Pistol River above head of tide 10 mi. south of Gold Beach. | T38S, R14W Sec. 21 | --- | 1935, 1938, and 1949-1952 | [148] |

ROGUE RIVER



ROGUE RIVER

General Description of Estuary and Drainage Basin

Estuary

Rogue River Estuary lies 264 miles to the south of the mouth of the Columbia River. Although relatively small in terms of surface area (Table A), it has an extremely large drainage basin, the central section of which is within the Siskiyou National Forest. Population in the vicinity of the estuary is concentrated in the small incorporated town of Gold Beach just to the south of the mouth. Census figures and estimated locations of this and the other four towns to river mile 45 are given in Table 1.

Table 1. Population centers at Rogue River Estuary [111,116].

| Name | Approximate location | Population |
|---------------------------|----------------------------------|------------|
| Gold Beach ⁽¹⁾ | Rogue River; mile 0; south side | 1,554 |
| Wedderburn | Rogue River; mile 0; north side | 250 |
| Agness | Rogue River; mile 27; north side | 25 |
| Illahe | Rogue River; north side | rural |
| Marial | Rogue River; mile 43; north side | not listed |

(1) Incorporated.

HW surface area of the estuary, as estimated from the 1954 USGS Gold Beach Quad., is 575 acres [55].

Numerous tributaries discharge into the lower reaches of the Rogue River, the Illinois River being the largest. Monthly runoff records as of 1966 are available on punch cards from a total of 82 surface water gaging stations in the Rogue River watershed [98]. The three of these located nearest the estuary mouth are listed in Table 9. Computed average annual yield of the Rogue River at its mouth for the period from 1933 to 1955 was 5,661,000 ac-ft with extremes of nearly 9,000,000 ac-ft and slightly less than 3,000,000 ac-ft [116]. Annual yield of the Illinois River from 1929 to 1956 averaged 1,986,000 ac-ft with a high yearly mean of slightly over 1,000,000 ac-ft and a low of about 3,500,000 ac-ft [116].

The Port of Gold Beach is located at P.O. Box 1126, Gold Beach, Oregon, 97444; telephone number 247-6269 [106]. The Port Commission, along with the Curry County Planning Commission, is involved with planning and regulating land use of the estuary zone [81].

ROGUE RIVER

General Description of Estuary and Drainage Basin

Drainage Basin

The Rogue River drainage basin covers 5,100 sq. mi. in Jackson, Josephine, Curry, Klamath, Douglas, and Coos Counties of Oregon and Siskiyou and Del Norte Counties of California. Over 75% of the basin is timberland, and 9% is used for agriculture. The average annual growing season at Gold Beach is 280 days. The fresh water yield at the estuary mouth average 5,661,000 ac-ft per year during the period from 1933 to 1955 as perviously described. Precipitation in the coastal section average 120 inches at the highest elevations, 60 inches to the east, and 90 inches along the coast. the central and eastern portions receive from 20 to 60 inches per year [116]. there are numerous climatological stations in the area of which at least 43 have records available on punch cards through the OSWRB. Those situated closest to the estuary are included in Table 9 [92,143]. Average annual temperatures in the western watershed ranges from 40°F to 67°F along the coast and from 32°F to 75°F in the mountains. In the central and eastern portions of the watershed, temperatures average from 17°F to 92°F [116].

Rogue River system stream profiles appear on page 154.

Hydraulic Description of Estuary

Tides and Currents

The estuary is described as being moderately exposed to waves at the throat. The mean tide range is 4.9 feet with a diurnal range of 6.7 feet. Tidal prism on mean range is 1.59×10^8 cu. feet [55].

River Discharges

Several USGS stream gaging stations are in operation on the Rogue River and its tributaries. These are listed in the USGS publication, "Water Resources Data for Oregon, Part I. Surface Water Records" [140]. Information concerning two stations located in the lower reaches of the Rogue and Illinois Rivers is given in Table 9, and the maximum, minimum, and mean flow rates recorded at them are given in Table 2. Average monthly flow at the mouth of the Rogue River during the period from 1933 to 1955, as determined by extrapolation of data to that point, ranged from a high flow rate during January of 16,200 cfs to a low flow rate during September of 1,200. Mean stream flow for the entire period was 7,800 cfs [116].

Salinity and Classification of Mixing

No information.

ROGUE RIVER

Hydraulic Description of Estuary

Table 2. Recorded flow rates of Rogue and Illinois Rivers [140].

| Stream | Point of measurement (rivermile) | Drainage area (sq.mi.) | Period of record | Flow rate (cfs) | | |
|----------------|----------------------------------|------------------------|------------------|-----------------------|------------------|-------|
| | | | | maximum | minimum | mean |
| Rogue River | mile 29.7 | 3,939 | 10/60-(1971) | 290,000 (12/23/64) | 608 (7/68) | 6,386 |
| Illinois River | mile 3.0 | 988 | 10/60-(1971) | 225,000 (12/22/64) | 135 (10/7/70) | 4,439 |

() This is not the last year of record.

Sediments

Net littoral drift in the area is from north to south [57].

Analyses of dredge material taken in January 1962, November 1965, and July and November 1971 are available through the Corps of Engineers. Results shown that (1) organic contents of the sample ranged from 1.19% to 1.94%, both samples having been taken during July 1971, (2) void ratios ranged from 0.297 (November 1965) to 0.838 (July 1971), and (3) the mean grain size varied from fine gravel to fine sand [124].

Water Quality Information

There are presently no DEQ water surveillance stations on the Rogue River, but the USGS operates some water quality and numerous water temperature stations in the watershed. Records are available from various publications by that agency [138,139,141]. Those stations located closest to the estuary are described in Table 9.

Biological Information

The Rogue River Basin stream systems provide spawning grounds for numerous adult anadromous salmonids and is used especially heavily by chinook and steelhead, as indicated in Table B. A partial breakdown, by stream system within the basin, is given in Table 3, and a more complete breakdown is given in "Environmental Investigations, Rogue River Supplement" [116]. The remainder of the information presented in this section was taken from a preliminary report to that publication described in the introduction [81].

ROGUE RIVER

Biological Information

Table 3. Estimated numbers of adult anadromous salmonids spawning in the Rogue River Basin stream systems [123].

| Stream system | Chinook | | Coho | Chum | Steelhead | | Sea-run Cutthroat |
|-----------------------------|---------|--------|-------|------|-----------|--------|----------------------|
| | Spring | Fall | | | Winter | Summer | |
| Rogue River ⁽¹⁾ | 44,275 | 41,850 | 2,085 | 50 | 20,150 | 36,950 | 2,400 |
| Illinois River | 0 | 20,000 | 1,400 | 0 | 30,000 | 0 | 2,500 |
| Rogue River Basin totals | 45,500 | 75,000 | 5,000 | 50 | 75,500 | 51,250 | 5,300 |

1

Main stem and tributaries other than Lobster Creek, Illinois River, Applegate River, Bear Creek, Little Butte Creek, Big Butte Creek.

Game fish found in the estuary at least during a part of the calendar year (in order of abundance) are: summer steelhead; winter steelhead; fall chinook; spring chinook, sea-run cutthroat, shad, coho, green sturgeon, white sturgeon, and chum salmon. Non-game fish found in the estuary are: anchovy, surf smelt, herring, red-tail surf perch, silver surf perch, spot--fin perch, striped perch, starry flounder, tom cod, and ling cod.

A common waterfowl found in or near the Rogue River Estuary is the American merganser. "Medium" common waterfowl found are: American widgeon, pintail, red-breasted merganser, surf scoter, and white-winged scoters.

Shore and other birds most commonly found in or near Rogue River Estuary are: great blue heron, least sandpiper, western sandpiper, western gull, herring gull, California gull, belted kingfisher, common crow, and double crested cormorant.

Common mammals found in or near Rogue River Estuary are: California sea lion, stellers sea lion, and black-tailed deer. "Medium" common mammals found are: harbor seal, river otter, and beavers. Uncommon mammals found are: mink and muskrats.

Physical Alterations

U.S. Army Corps of Engineers modifications to Rogue River Estuary, described in Table 4, consist of two jetties, a turning basin, and a channel from the entrance to the turning basin.

ROGUE RIVER

Physical Alterations

Table 4. U.S. Army Corps of Engineers to Rogue River [126,129].

| Proposed modification | Location | Dimensions | | | Date and Status ⁽¹⁾ |
|-----------------------|--|-----------------|-----------------|--|---------------------------------|
| | | depth (feet) | width (feet) | length (feet) | |
| north jetty | entrance | | | | 1960-completed 1966-repaired |
| south jetty | entrance | | | | 1960-completed |
| Channel | | 13 | 300 | from the ocean to a point 1/4 mile down- stream from the Highway 101 bridge | |
| turning basin | north section of the estuary 1/4 mile down- stream from the highway 101 bridge. | 13 | 500 | 650 | |

Although the Rogue is one of the estuaries dredged by the U.S. Army Corps of Engineers [50], statistics of such were not found. Waterborne traffic through the project during 1969 totaled 106,000 tons of which over 90% was lumber shipments. Annual use from 1960 to 1969 averaged 67,000 tons. Passenger traffic on the project during 1969 consisted of 113,000 persons, most of whom were on the mail boat to Agness [129].

The OSGC operates the Butte Falls Hatchery located on Butte Creek near Butte Falls in the eastern section of the drainage basin [56]. According to the OSGC Annual Report, releases from the hatchery totaled 371,490 during 1970 and consisted of 152,762 rainbow trout, 98,885 spring chinook, and 119,843 summer steelhead [80].

Fishways in the Rogue River system are all operated by the FCO. Their names and general locations are as follows [28]: Savage Rapids Dam--Rogue River; Oak St. Div. Dam--Bear Creek; Bear Creek Div. Dam--Bear Creek; Frilder Dam--Rogue River.

ROGUE RIVER

Estuary Uses

Industrial and Commercial

The economy of the entire Rogue River Basin is based on timber, agriculture, offshore commercial fishing, minerals, and recreation. The timber industry has been of primary importance since 1940. Before that time, the major emphasis was on agriculture, and prior to that mining ranked as the most important activity. Timberlands account for over 75% of the basin area, and nearly 95% of those lands are commercial. Only 9% of the basin is used for agricultural purposes. Half of that 9% is dry pastureland. About 75% of the farms produce cattle or dairy products [116].

In the lower Rogue River basin, which includes the estuary area, the economy is based on timber and tourism with the center at Gold Beach and Wedderburn [127]. Manufacturers in the area, listed in Table 5, all have addresses in those two towns and are mostly logging camps and logging contractors [71]. In terms of tourism and recreation, the area is one of the most popular for sport fishing in the South Coast district with port facilities and resorts. More descriptions of the angling activities is given in the following section. Commercial fishing also provides some income to the area, as shown in Table 6, and is extensive enough to support a cannery at Wedderburn (Table 5).

Table 5. Major manufacturers at Rogue River Estuary [71].

| Location | Name | Type of business | Number employed |
|------------|---|-------------------------------|-----------------|
| Gold Beach | U.S. Plywood | plywood | 300 |
| | Chipco | wood chips; box shook; veneer | 60 |
| | Laird Logging Co. | contract logging | 50 |
| | Tamco Co. | veneer; box shook | 36 |
| | 23 manufacturers employing 15 or under; 1 are logging camps or logging contractors; | | |
| Wedderburn | Rogue River Cannery Inc. | canned fish and seafood | 4 |

ROGUE RIVER

Estuary Uses

Industrial and Commercial

In the case of the Illinois River basin, agriculture is the economy base. Tourism is important to a lesser degree, and although there is some logging, it is limited due to the relative inaccessibility of most land. Agricultural activities are concerned mainly with raising dairy and beef cattle and various types of crops [116].

Table 6. Commercial harvest of food fish
received at Gold Beach, 1971 [34].

| Species | Harvest (pounds round weight) | Fishermen value |
|---------------|----------------------------------|--------------------|
| Coho | 185,414 | \$58,000 |
| Chinook | 45,052 | 23,000 |
| Ground fish | 5,830 | --- |
| Albacore tuna | 953 | --- |
| Crabs | 300 | --- |
| Pinks | <u>45</u> | <u>---</u> |
| TOTAL | 237,594 | \$81,000 |

Recreational

The Rogue River, particularly popular for its steelhead fishing, is also a good salmon stream. The lower reaches of the river provide good salmon fishing starting in April and continuing through the summer and fall. Late in September Coho enter and are present until December. In the upper reaches around Grants Pass, mid-March marks the first good fishing with the run continuing into June. Chinook and Coho can be caught offshore from mid-July through September [58]. Estimated annual harvest data for sport fishing in the area are given in Table 7.

According to the OSGS study conducted during March and April of 1971, red-tail perch were most commonly taken by shore anglers [28].

Hunting data, as presented in "Environmental Investigations, Rogue River Basin Supplement," for big game, upland game, and waterfowl are given in Table 8 [123]. As indicated in Table 8, a breakdown is given of upland game and waterfowl harvest in that publication. It also provides furbearer trapping data, which includes beaver, otter, mink, muskrat, raccoon, skunk, weasel, gray fox, bobcat, and coyote.

ROGUE RIVER

Table 7. Estimated annual harvest data for Sport Fishing at Rogue River⁽¹⁾ [123].

| Species | Area fished | Annual harvest (total number) | Effort (angler-days) | Gross expenditure's |
|-------------------------|--------------------|----------------------------------|-------------------------|------------------------|
| Salmon | Estuary | 750 | 2,700 | \$ 55,500 |
| | Rogue River | 16,800 | 47,000 | 1,243,200 |
| | Illinois River | 150 | 900 | 11,100 |
| | Ocean (Gold Beach) | 4,750 | 11,500 | 351,500 |
| Steelhead | Rogue River | 32,500 | 95,000 | 2,405,000 |
| | Illinois River | 3,500 | 6,900 | 259,000 |
| | Applegate River | 2,000 | 6,000 | 148,000 |
| Sea-run Cutthroat | | 220 | 190 | 3,515 |
| Resident Salmonids | | 1,312,500 | 525,000 | 3,150,000 |
| Warm-water Game fish | | 51,000 | 17,000 | 102,000 |
| Shad | | 100 | 75 | 1,390 |
| Sturgeon | | 35 | 100 | 600 |
| Bay fish | | <u>14,220</u> | <u>1,580</u> | <u>9,480</u> |
| TOTALS | | 1,438,525 | 713,945 | \$7,740,285 |

(1) Based on recent annual averages.

Table 8. Rogue River hunting data, 1970 [123].

| Species | Hunters | Hunter days | Harvest | Gross Expenditures |
|--------------------------|---------|-------------|---------|--------------------|
| Big Game | | | | |
| deer | 12,986 | 88,560 | 5,043 | 1,780,056 |
| elk | 599 | 1,952 | 56 | 51,924 |
| Upland Game ¹ | 13,642 | 64,292 | 76,474 | 385,752 |
| Waterfowl ² | 1,611 | 9,061 | 8,433 | 72,488 |
| TOTALS | | 163,865 | 90,006 | 2,290,220 |

¹A breakdown of data for upland game (band-tailed pigeon, mourning dove, quail, grouse, pheasant, and silver gray squirrel) is available [134].

²A breakdown of data for waterfowl (ducks and geese) is available [134].

ROGUE RIVER

Table 9. Surveillance stations at Rogue River Estuary.

| Type of station | Name and/ or identifying number | Approximate location | Drainage area (sq.mi.) | Period of record | References |
|-----------------|---|--------------------------|------------------------|------------------|----------------------|
| Climatological | Gold Beach Ranger station; U.S. Weather Bureau (USWB) #3356 | elevation-- 50 feet | | 1890*(1967) | [92] |
| | Agness | elevation-- 200 feet | | 1914-1922 | [92] ⁽¹⁾ |
| | Illahé 1 N; USWB #4133 | elevation-- 330 feet | | (1967) | [92] ⁽¹⁾ |
| | Illahé 2 N; USWB #4135 | elevation-- 488 feet | | 1963*(1967) | [92] ⁽¹⁾ |
| | Marial 8 NNE; USWB #5217 | elevation-- 2,080 feet | | 1956*(1967) | [92] ⁽¹⁾ |
| Stream gaging | Rogue River near Agness; USGS #3723 | Rogue River; mile 29.7 | 3,939 | 10/60-(1971) | [140] ⁽²⁾ |
| | Illinois River near Agness; USGS #3782 | Illinois River; mile 3.0 | 988 | 10/60-(1971) | [140] ⁽²⁾ |
| | Illinois River near Selma; USGS #3780 | Illinois River mile 32 | 665 | 1957-(1966) | [98] |
| Water Quality | Rogue River near Agness; USGS #3723 | Rogue River; mile 29.7 | 3,939 | 10/60-(9/64) | |
| | Illinois River near Selma; USGS #3780 | Illinois River; mile 32 | | 10/61-(9/64) | [139] |

(continued)

Table 9. (continued)

| Type of station | Name and/ or identifying number | Approximate location | Drainage area (sq.mi.) | Period of record | Reference |
|-------------------|---------------------------------------|--------------------------|------------------------|------------------------------------|-----------|
| Water temperature | Rogue River near Gold Beach | Rogue River; mile 11.2 | | 3-10/60 | [138] |
| | Rogue River near Agness; USGS #3723 | Rogue River; mile 29.7 | 3,939 | 10/60-(9/70) | [138,141] |
| | Rogue River at Agness | Rogue River; mile 27.5 | | 10/59-11/60 | [138] |
| | Illinois River near Agness | Illinois River; mile 2.4 | | 11/59-10/60 | [138] |
| | Rogue River at Marial | Rogue River; mile 48.5 | | 5-10/60 | [138] |
| | Illinois River near Selma; USGS #3780 | Illinois River; mile 32 | 665 | 9/61-(9/62) (spot observations) | |

(1) Precipitation data available in punch card or printout form through the OSWRB.

(2) Monthly and water-year runoff records have been compiled and are available in punch card or printout form through the OSWRB.

() This is the most recent record date found and is not necessarily the last.

* Period of record is not continuous.

ROGUE RIVER PROFILE

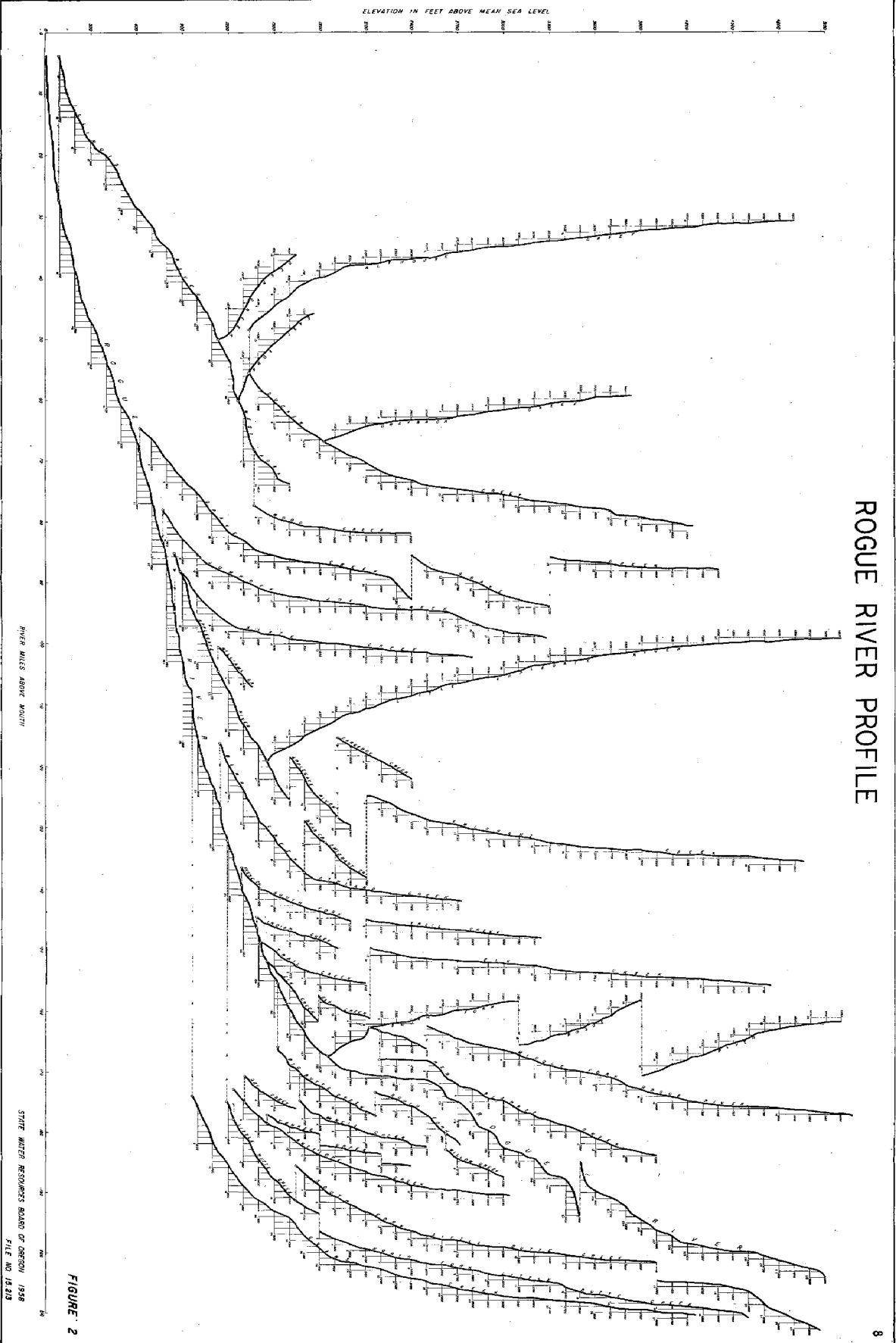


FIGURE 2

RIVER MILES ABOVE MOUTH

STATE WATER RESOURCES BOARD OF OREGON 1948
FILE NO. 18.213

SALMON BAY

SALMON BAY

General Description of Estuary and Drainage Basin

Estuary

Salmon Bay, the smallest estuary of those included here (Table A), lies roughly 85 miles south of the mouth of the Columbia River. Population in the area totals less than 100 and is centered in three towns, all on the Salmon River. These (with their 1970 populations) are Three Rocks (30) to the north at mile 0.3, Otis (15) to the south at mile 4.3, and Rose Lodge (20) to the south at mile 9.3 [88,94,111].

A nature conservancy area is located on the south side of Cascade Head and adjoins the estuary to the north [155]. Presently under consideration is the possibility of including Salmon Bay and some of the surrounding area as part of the Siuslaw National Forest. Reports on this were prepared by the U.S. Siuslaw National Forest Service prior to [150] and following [149] a public meeting held for the purpose of discussing this matter.

The estuary is about 270 acres in size; reported surface areas and tideland acres are given in Table 1 [59,70,153]. The tidelands are particularly extensive between the mouth and mile 2 to both the north and south and comprise about 60% of the total area [53,88-map no. 18.6].

Table 1. Reported surface areas of Salmon Bay [55,59,70].

| reference | surface area (acres) | measured at | tidelands | | submerged lands | |
|-----------|-------------------------|-------------|-----------|---------|-----------------|---------|
| | | | acres | percent | acres | percent |
| [55] | 171 | HW | | | | |
| [59] | 438 | 1 | 250 | 57 | | |
| [70] | 204 | MHT | 126 | 62 | 78 | 38 |
| | 78 | MLT | | | | |

¹Specified by Marriage as the area affected by tidal action.

The estuary is essentially part of the lower reaches of the Salmon River, as its mouth and the zero river mile are at the same point. The river measures 25.3 miles to its source and has about four small tributaries from the north and three from the south to the head of tidewater at mile 4.3 [88-map no. 18.6].

Watershed

Salmon Bay (River) drains an area of 75 sq mi [94], which yields an average of 450,000 ac-ft of fresh water annually [70,85,88]. The

Salmon Bay

watershed, plus an adjacent coastal area to the north of 3 sq mi, is comprised of 94% (73 sq mi) forest; 3% (2 sq mi) rangeland; 2% (2 sq mi) cropland; and 1% (1 sq mi) "other" [88].

Average annual precipitation varies from 90 inches along the coast to 180 inches on the Coast Range Divide [53,88]. There is a climatological station at mile 5 of the Salmon River (Table 4) [88,143].

Elevations range from sea level to 2,900 feet [88].

Hydraulic Description of Estuary

Tides and Currents

The bay is described as being partially exposed to waves at the throat [55], and tidal effects reach mile 4.3 of the Salmon River [69]. The mean tide range is 5.8 feet with a diurnal range of 7.6 feet and an extreme range of 13.0 feet [86].

River Discharges

The only stream gaging station on the Salmon River stream system for which records were found is located at mile 0.1 of Alder Brook, a tributary of the Salmon River at mile 10.7 (Table 4) [140]. Records from 1954 to 1970 show 50 cfs on January 24, 1970 as the maximum flow rate at this point during those 6 years.

Estimates (based on precipitation, runoff, and some spot observations) of the average discharge, by month, of the Salmon River "near tidewater"¹ have been made for 1937 to 1963 [88]. February had the high estimated monthly discharge at 1,169 cfs and August the low at 44 cfs. Mean discharge was 538 cfs. The mean minimum flow at tidewater¹ has been estimated as 18 cfs and observed as 21.7 cfs.

Salinity and Classification by Mixing

No information.

Sediments

Littoral drift varies [57]. Sediments deposited in the estuary by fresh-water drainage are estimated to average 14,000 tons annually [85].

1 The river mile location was not given.

Salmon Bay

Water Quality Information

The DEQ has taken water samples at Salmon Bay. Data is now available for the 1972 year (2 measurements) (Table 4) [67,68].

Biological Information

Estimated numbers of adult anadromous salmonids spawning in the Salmon River system are spring chinook--180; fall chinook--2,000; coho--5,700; summer steelhead--250; winter steelhead--4,200; and sea-run cutthroat--3,800 [75]. Figures for all species mentioned here are low in comparison with those for other stream systems (Table B).

Salmon, flounder, perch, sea-run cutthroat, limpets, staghorn sculpin, dungeness crab, and ghost and mud shrimp are commonly caught by anglers, as described under "Estuary Uses." The estuary is essentially fresh water and it supports a small quantity of soft shell clams [53].

Waterfowl and about 100 species of other birds can be found on or near the estuary [150,155], and the surrounding area is a winter range for black-tailed deer, Roosevelt elk, and cougar, with black-tailed deer being the most abundant. Roosevelt elk are being transplanted into the Mid-Coast Basin by the OSGC and are increasing in number [75].

Physical Alterations

Jetties have not been constructed, nor has dredging by the U.S. Army Corps of Engineers occurred, but in 1948 the Corps did remove rocks just downstream from Three Rocks located near the mouth [129]. Navigable length of the Salmon River is 3.0 miles [69].

An inventory of filled lands in the Salmon River has been completed by the Division of State Lands and some of the information from that report is presented in Table C [69].

In June 1963 the Trout Creek Fishway was completed under the FCO "Coastal 60-40 Program" [119]. It is located on Trout Creek, near mile 1.25, or roughly 11 miles from the estuary mouth. (Trout Creek flows into Slick Rock Creek about 1 mile from the mouth of the latter, and Slick Rock Creek discharges into Salmon River at mile 8.8 [94].)

Estuary Uses

Industrial and Commercial

Forestry, agriculture, fishing, recreation and summer homes are of primary economic importance to the Salmon River area [88]. Commercial

Salmon Bay

fish landings from the ocean or estuary apparently either are not received at Salmon Bay or are not considered extensive enough to report (Tables D and E). The only manufacturers there listed in Table 2, are three small logging operations in Otis and Rose Lodge [71].

Table 2. Major Manufacturers at Salmon Bay [71].

| Location | Name | Type of Business | Number Employed |
|------------|---------------------------|------------------|-----------------|
| Otis | Jurhs Logging Co. | logging | 7 |
| | Ted E. Bray Co. | logging | 1 |
| Rose Lodge | Holliday Hauling Co. Inc. | logging | 15 |

Recreational

Species other than salmon and trout most commonly taken by sports fishing, as determined in the FCO study from March to October 1971, are as follows: shore angling--limpets, staghorn sculpin, and starry flounder; boat angling--dungeness crab and starry flounder; and clamming--ghost and/or mud shrimp [38]. Estimated annual harvest data for angling in the area (ocean, estuary, and streams) are shown in Table 3 [75].

Table 3. Estimated Annual Harvest Data For Sport Fishing at Salmon Bay⁽¹⁾ [75].

| Species | area fished | annual harvest (total number) | effort (angler-days) | gross expenditures |
|-----------------------|--------------|-------------------------------|----------------------|--------------------|
| Salmon | Estuary | 550 | 2,200 | \$ 40,700 |
| | Salmon River | 310 | 1,240 | 22,940 |
| | Ocean | 390 | 520 | 28,860 |
| Sea-run cutthroat | Estuary | 560 | 2,800 | 51,800 |
| | Salmon River | 105 | | |
| Steelhead | Salmon River | 2,240 | 8,960 | 165,760 |
| Non-salmonid bay fish | Estuary | 1,800 | 600 | 3,600 |

¹Average of data from past years.

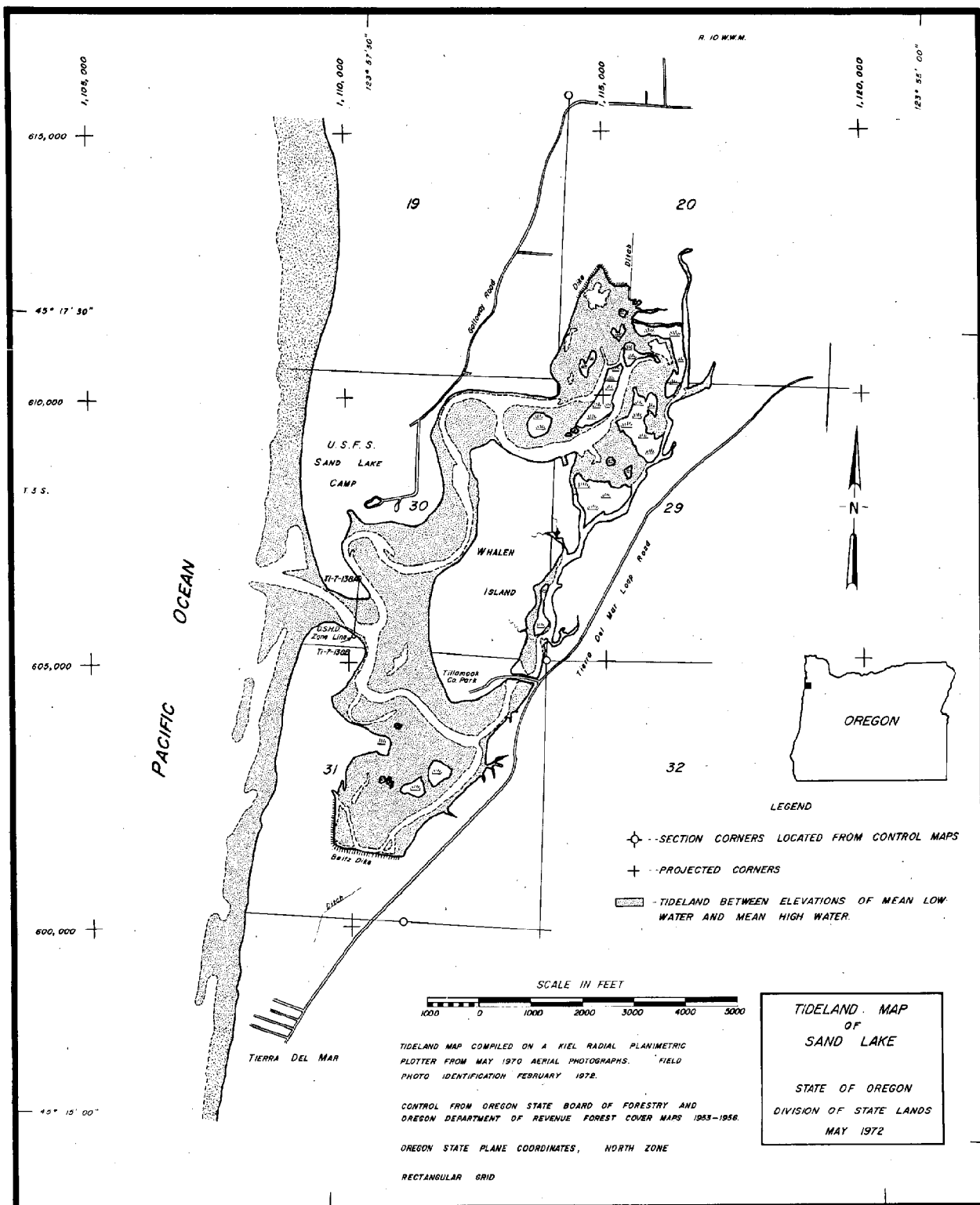
Salmon Bay

Table 4. Surveillance stations at Salmon Bay.

| Type of station | Name and/ or identifying number | Approximate location | Drainage area (sq.mi.) | Period of record | References |
|------------------------|---|--|------------------------|------------------|------------|
| Climatological | Otis 2 NE | Salmon River; mile 5 | 150 | 1948-(1963) | [88,143] |
| Stream gaging | Alder Brook near Rose Lodge; USGS #8037 | Alder Brook, mile 0.1; 10.8 miles from the estuary mouth | 1.09 | 1954-(1970) | [140] |
| Crest stage | " | " | " | 1954-(1963) | [88] |
| DEQ water surveillance | #1. 1/2 mile below public boat ramp | 45° 05' 48" N 124° 00' 00" W | | | [67,68] |
| " | #2. 1/4 mile below public boat ramp | 45° 02' 29" N 123° 59' 48" W | | | |
| " | #3. opposite public boat ramp | 45° 02' 22" N 123° 59' 14" W | | | |
| " | #4. 1/4 mile above public boat ramp | 45° 02' 18" N 123° 59' 05" W | | | |
| " | #5. 1/2 mile above public boat ramp | 45° 01' 54" N 123° 59' 05" W | | | |
| " | #6. 3/4 mile above public boat ramp | 45° 01' 49" N 123° 58' 35" W | | | |
| " | #7. Hwy 101 Bridge | 45° 01' 34" N 123° 58' 05" W | | | |

() This is the most recent record date found and it not necessarily the last.

SAND LAKE



SAND LAKE

General Description of Estuary and Drainage Basin

Estuary

Sand lake, located about 70 miles south of the mouth of the Columbia River, is the second smallest estuary of those included here (Table A). The area is sparsely populated with no towns on the bay itself. Sandlake, described as rural, is located 1 mile northeast of the estuary, and Tierra del Mar with a 1970 population of 40 lies on the coast, about 1 mile south of the estuary mouth [111,89-chart].

Surface area of the estuary is about 550 acres, of which 75% is tidelands (Table 1).

Table 1. Reported surface areas of Sand Lake [55,70,155].

| reference | surface area (acres) | measured at | tidelands | | submerged lands | |
|-----------|-------------------------|---------------|-----------|---------|-----------------|---------|
| | | | acres | percent | acres | percent |
| [2] | 700 | not specified | | | | |
| [6] | 429 | HW | | | | |
| [117] | 528 | MHT | 397 | 75 | 131 | 25 |
| | 131 | MLT | | | | |

Major tributaries are Sand and Jewel Creeks, which flow into the bay from the north. Gurtis Creek from the east and Reneke Creek from the south are its only other tributaries. None of these streams appear to be longer than 4 or 5 miles [53,89-chart].

Drainage Basin

Sand Lake and its tributaries drain an area of about 17 sq mi [89-chart]. An estimate of the average annual water yield of the North Coast Basin is 3,000 ac-ft/sq mi [89]. Using this figure, the watershed yields 51,000 ac-ft of fresh water annually, an amount somewhat less than the 60,000 ac-ft reported by the Division of State Lands [70].

Yearly precipitation ranges from 95 inches along the coast to 110 inches in the northern watershed [89].

Sand Lake

Hydraulic Description of Estuary

Tides and Currents

The bay is described as being fully exposed to waves at the throat. The mean tide range is 5.7 feet with a diurnal range of 7.5 feet [55]. The channel network in the estuary as observed through aerial photographs is complex [53].

River Discharges

No records from stream gaging stations in this area were found.

Salinity and Classification by Mixing

Salinity is high in concentration [155].

Sediments

Littoral drift varies but tends to be to the south during the summer and to the north during the winter with the net drift being to the south, as indicated by the accumulation of driftwood and sand at the southern third of Sand Lake Beach [57]. An estimated 2,500 tons of sediments are deposited in the estuary by its tributaries annually [85].

Water Quality Information

The DEQ apparently operates no surveillance stations here, and records from other water quality stations were not found.

Biological Information

Of all the streams of the Sand Lake stream system (about 12), seven are reportedly used by anadromous fish, but no estimates of the number of fish using the streams were given [77]. The bay supports bent nose clams (unimportant for food) and ghost shrimp, and it provides excellent fishing for flounder, crabs, and staghorn sculpin [38,155].

Ducks and geese use it as a feeding, resting, and wintering spot [69,89,155].

Sand Lake

Physical Alterations

Jetties have not been constructed, and records show that dredging by the U.S. Army Corps of Engineers has not been performed [55]. Also, as reported in the Division of State Lands inventory of filled lands in Sand Lake, there are no landfills, but three dike-type structures have been built [69]. One is part of the county road leading to Tillamook Park on Whalen Island, another is on the northern shore of the estuary and reportedly is intended for flood control, and the third, located on the southern shore and called "Beltz Dike," is believed to have been built to help extend the limits of grazing lands there. Some further description is given in Table C, and more details can be gotten from the inventory report.

Estuary Uses

Industrial and Commercial

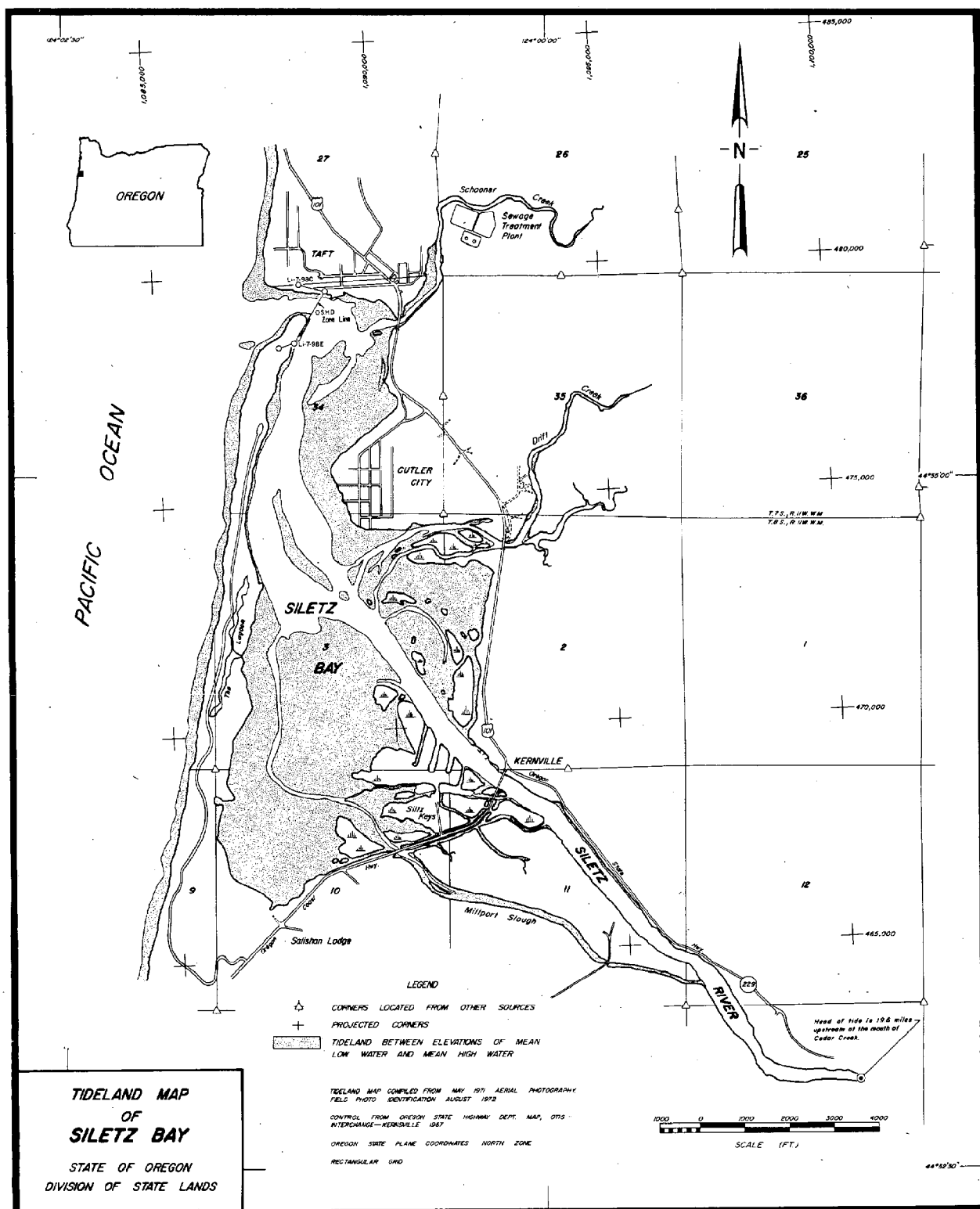
There are no manufacturers or industries at Sand Lake [71,155], nor is there commercial fishing [69]. Agricultural lands in the vicinity are cultivated for the production of hay and pasture, both of which are used for the support of livestock [89],

Recreational

Recreational fishing (for species other than salmon and trout) at Sand Lake, according to statistics from the FCO study, is best for shore anglers [38]. During the period from March to October 1971, they caught mostly staghorn sculpin, starry flounder, and shore crabs. Clammers took mainly ghost shrimp and relatively few mud shrimp, and boat anglers landed a limited number of starry flounder and dungeness crab.

There are two public camp grounds in the area, and they are both used heavily during the spring and summer. One is the USFS Sand Lake Camp on the northern spit, and the other is Tillamook County Park, on Whalen Island located in the northeast corner of the bay. The latter provides a boat ramp [69,150,155].

SILETZ BAY



SILETZ BAY

General Description of Estuary and Drainage Basin

Estuary

Siletz Bay lies roughly 95 miles south of the Columbia River mouth. As the ninth largest of the estuaries included here (Table A), it is relatively small in size.

In 1964, the only towns on the bay (Taft and Cutler City) were consolidated with several others in the coastal zone to the north to form the incorporated city of Lincoln City. These and other population centers in the area are listed in Table 1.

Table 1. Population centers at Siletz Bay¹ [88,95,111].

| name | general location | river mile location | approximate distance from estuary mouth (miles) | 1970 population |
|-----------------------------|----------------------------|---------------------|---|-----------------|
| Lincoln City ^{2,3} | coast; north of estuary | | | 4,198 |
| Taft ³ | Siletz Bay; north side | | 0 | 557 (1960) |
| Cutler City ³ | Siletz Bay; northeast side | | 1 | |
| Kernville | Siletz River; north side | 0.5 | 2.5 | 50 |
| Reed Creek | Siletz River; north side | 22.0 | 24.0 | not listed |
| The Maples | Siletz River | 26.2 | 28.2 | not listed |
| Siletz ² | Siletz River | 35.3 to 41.3 | 37.3 to 43.3 | 596 |
| Gleneden Beach | Sijota Creek; west side | 1 | 4 | 500 |

¹Tidal effects extend approximately to mile of the Siletz River.

²Incorporated

³Taft and Cutler City were consolidated with several other towns in 1964 to form Lincoln City.

Surface area of the estuary is about 1,160 acres (Table 2). Cross-sectional areas at MTL at various distances from the mouth are shown in Table 3 [43].

Table 2. Reported surface areas of Siletz Bay [55,59,70].

| reference | surface area (acres) | measured at | tidelands | | submerged lands | |
|-----------|----------------------|-------------|-----------|---------|-----------------|---------|
| | | | acres | percent | acres | percent |
| [55] | 1,086 | HW | | | | |
| [59] | 1,203 | 1 | | | | |
| [71] | 1,187 412 | MHT MLT | 775 | 65 | 412 | 35 |

¹Specified by Marriage as the area affected by tidal action.

Siletz Bay

Table 3. Cross-sectional areas of Siletz Bay [43].

| points of measurement | distance from mouth (miles) ¹ | cross-sectional area (sq ft) |
|-----------------------|---|---------------------------------|
| Taft | 0.19 | 3,400 |
| Kernville | 2.5 | 5,400 |
| Howard's | 10.8 | 2,200 |
| Strome | 18.0 | 1,100 |

¹ Mile values were obtained by conversion from distances reported in feet.

The major tributary of Siletz Bay is the Siletz River. Its point of discharge into the bay (about 2 miles from the mouth) is considered its zero mile [94,88-map #15.6]. Length to its source (the confluence of the North Fork Siletz River and Boulder Creek) measures 72.1 miles [95]. It drains an area of 308 sq mi [94] and yields an average of 1,400,000 ac-ft of fresh water annually [88]. Other tributaries discharging directly into the bay are Schooner Creek from the north and about 1 mile from the mouth, Drift Creek from the east and about 1.5 miles from the mouth, and a smaller stream from the south [88-map #18.6]. Schooner Creek drains 15 sq mi and has an average annual fresh water yield of 80,000 ac-ft [88]. Drift Creek has a length of 21.3 miles; drains 41 sq mi [94]; and yields an average of 190,000 ac-ft of fresh water annually [88].

The Siletz Bay Regional Planning Advisory Committee has monthly meetings at which various types of information about the area have been presented [114]. An attempt has been made to summarize some of that material here.

Drainage Basin

Siletz Bay has a drainage area of 373 sq mi [88-map #18.6] which yields an estimated 1,780,000 [117] to 1,800,000 [85] ac-ft of fresh water annually.

Figures given for that portion of the watershed drained by the Siletz River (308 sq mi or 82%) show it to be composed of 94% (289 sq mi) forests; 3% (9 sq mi) cropland; 1% (4 sq mi) rangeland; and 2% (6 sq mi) "other." Precipitation in the watershed averages from 70 inches along the coast to over 180 inches in the headwaters of the Siletz River [88].

Elevations of the Siletz River portion of the watershed range from sea level to 2,850 feet along the Coast Range divide [88].

Siletz Bay

Hydraulic Description of Estuary

Tides and Currents

The bay is described as being fully exposed to waves at the throat [55]. Head of high tide for the Siletz River is 24.2 miles (128,000 feet) from the estuary mouth where the drainage area is 268 sq mi. [43]. The mean tide range is 5.0 feet [55]. Tidal prism on mean range (tidal prism between MLLW and MHHW) is 3.5×10^8 cu ft [43]. Goodwin has found a marked choking of the tidal range taking place through the entrance of the estuary (probably due to channel constrictions) and also found a phase difference of 90 to 100 degrees between tidal elevations and tidal currents [43]. A calibrated numerical tidal hydraulic model of the Siletz has been provided by Goodwin [42].

As a result of the geometry of the entrance, the maximum flood and ebb currents occur at different locations within the estuary. In its first mile (the area between Taft and Cutler City) the flood currents occur along the east side of the bay, while the ebb currents occur along the west side near a sand spit located there [53]. Seasonal (1973) measurements of salinity, temperature, turbidity, pH and dissolved oxygen have been taken for high and low tides with depth and length within the estuary [112].

River Discharges

A stream gaging station located on the Siletz River at mile 42.6 (near the town of Siletz) has been in operation periodically since October 1905 (Table 6). The average recorded discharge for the time up to 1970 was 1,573 cfs with a maximum of 34,600 cfs (November 22, 1909) and a minimum of 48 cfs (September and October 1965 and October 1967). [140]. The normal river flow at the mouth of the Siletz River is estimated at 1,930 cfs [85].

Drift Creek has a computed minimum flow of 22 cfs [88].

Salinity and Classification by Mixing

Burt and McAllister took salinity measurements in the Siletz River once during each of the following months: October 1957, January, April, and July 1958 [12]. Salinity intrusion was greatest on July 25, 1958 at LHW when it reached a point 12.7 mi from the ocean. It was detected at a concentration of 0.4 ppt at the surface and on the bottom (7 feet) with concurrent temperatures of 21.3° C at both points. Measurements beyond this were not reported.

The estuary, as classified by Burt and McAllister on the basis of salinity change from top to bottom, was found to be a two-layered system in January and April and a partly-mixed system in October [13].

Currents and tidal ranges have been measured (1973) to determine the times of maximum ebb and flow [112].

Siletz Bay

Sediments

Littoral drift in the area varies, but it is believed to be to the north [57]. A problem within the estuary has arisen from the large volume of fresh water inflow as it carries an estimated 74,000 tons [85] of sediments to the estuary annually, resulting in a gradual filling [53]. There are delta deposits near the mouth of Drift Creek [53], and a spit with dunes has formed at the mouth of the Siletz River [57]. Four sand bars have formed northeast of Cutler City, as a result of the flow pattern of the ebb and tidal currents as previously described [53].

Analysis of sediments for grain size, porosity and volatile solids along the length of the estuary have been determined for summer and winter (1973) conditions [112].

Of recent concern is the erosion of Salishan Spit located just south of the estuary mouth.

Water Quality Information

There are six DEQ water surveillance stations in Siletz Bay (Table 6) with records from four sampling dates between July 1969 and April 1972 available from most of them [67,68]. The USGS operates water quality stations on the Siletz River--one at mile 34 and another at mile 42.6 where it also has a water temperature station (Table 6) [88,138].

The greatest water quality problem reportedly results from siltation in the streams and in the bay. Effluent and other pollutants discharged into the waters are also of concern [114-8/2/72, J. Fortune].

Biological Information

The Siletz River system provides spawning grounds for more spring chinook and summer steelhead than any other stream system of the Mid-Coast Basin (Table B) [75]. Estimated numbers of these and other salmonids spawning in the river system are as follows [75]: spring chinook--775, fall chinook--14,200, coho--26,900, summer steelhead--4,900, winter steelhead--11,500, and sea-run cutthroat--32,000. These all provide good sport fishing. Other species commonly caught include staghorn sculpin, shiner perch, dungeness crab, starry flounder, and ghost shrimp [38,155].

Some softshell clams can be found along the east side of the estuary between Cutler City and Kernville [155], but most clambeds have been silted in. There is an experimental plant of Manila Littlenecks [114-7/5/72 D. Snow].

Siletz Bay

The estuary is used during migration and wintering by waterfowl [155] with the Millport Slough area (to the southeast of the bay) being used particularly heavily by various species of ducks and occasionally by Canadian Geese. Ruffed grouse are among the game birds found in the estuary area, and blue grouse and mountain quail are found at middle and high altitudes of the watershed. Band-tailed pigeons are quite common, particularly in the vicinities of Millport Slough and the mouth of Drift Creek which they use for watering. The Drift Creek and Schooner Creek areas provide nesting and feed for bald eagles [114-8/2/72; G. Hatten].

The area around the estuary is a winter range for big game such as black-tailed deer, Roosevelt elk, black bear and cougar. Of these, black-tailed deer are the most abundant and can be found at a concentration of 1.8 deer/sq mi in the upper areas. Elk are being transplanted to the Mid-Coast Basin (34 to the Drift Creek area) by the OSGC and are increasing in number, [75,114 -8/2/72 G. Hatten].

Beaver, muskrat, nutria, and raccoon are examples of some of the many fur-bearing animals in the area. Beaver are generally trapped at a rate of 30-40/year [114-8/2/72, G. Hatten].

Physical Alterations

Jetties have not been constructed, but a survey was authorized by Congress in 1964 to consider the possibility of constructing a small-boat basin and jetties near Taft. As of 1971 (publication date), work on the report was in progress [129]. The jetties, in addition to protecting the entrance to the ocean, would probably increase the flushing action of the river and thereby inhibit the silting-in of the bay. Opening up Millport Slough is also expected to result in a decrease of the filling of the bay and this too is apparently being considered [114-7/2/72, D. Snow].

The FCO operates the Siletz River Salmon Hatchery on the North Fork Rock Creek. It lies 4 or 5 miles east of the town of Logsdon, or about 53 miles from the mouth of the Siletz River. Releases (into Rock Creek) between July 1, 1968 and June 3, 1969 consisted of 377,402 coho [33,54,88].

Dams have been constructed at mile 4.3 of the South Fork Siletz River (Valsetz Dam) and at mile 9.7 of Drift Creek [94].

Estuary Uses

Industrial and Commercial

Of economic importance to the watershed are forestry, agriculture, rock and gravel mining, tourism, recreation, and summer homes [88]. Since Siletz Bay is located within the "20 miracle miles" of Oregon's coast where vacationing is popular, tourism, summer homes, and recreation

Siletz Bay

are of particular importance to the population there. Kernville, Cutler City, and Taft are the resort areas on the estuary [88]. Most of the manufacturers there, listed in Table 4, have Lincoln City addresses and deal in lumber and wood products.

Table 4 Major Manufacturers at Siletz Bay [71].

| Location | Name | Type of Business | Number Employed |
|----------------|---|---|-----------------|
| Lincoln City | L. Jepson and Sons | contract logging | 50 |
| | Oceanlake Ready-Mix Co. | concrete and crush rock | 25 |
| | Fallon Logging Co. | fir/alder/hemlock pulp | 22 |
| | 10 manufacturers employing less than 15 | dealing mainly in lumber and wood-products (mostly logging) | |
| Gleneden Beach | Gleneden Brick and Tile Work | concrete pipe and building blocks and bricks | 5 |

Farmlands, recently used mainly for stable farming/ranching/dairying activities are now being purchased for recreational development. The farms which are increasing in number are those such as nurseries and tree and berry farms dealing in more specialized products and having higher incomes. Those which have lower incomes are rapidly decreasing in number. For example, the number of county farms grossing less than \$5,000 dropped 50% from 1964 to 1969, while those grossing over \$9,999 nearly doubled during the same time period [114-7/5/72, J. Gurton].

Commercial fishing and clamming formerly provided some income to the area. Now, however, most clam beds have been silted in and commercial fishing is extremely limited, with the commercial salmon fleet once supported there no longer existing [75, 114-7/5/72, D. Snow]. In fact, statistics of commercial landings of salmon and other species received at various bays during 1971 (Tables D and E) show sand shrimp, crawfish, and eel as the only ones received at Siletz with a total catch for the year of 176 pounds at essentially no value to fishermen [34]. Also, of the various species such as clams, crabs, oysters, bait shrimp, and shad harvested directly from estuaries of the Mid-Coast Basin, bait shrimp was the only one taken at Siletz Bay. Such landings have averaged 700 pounds over the past years with a retail value to fishermen of \$920 [75].

Recreational

While commercial fishing at Siletz Bay is limited, sport angling is quite popular. It has good potential, but problems apparently arise from limited

Siletz Bay

angler access and low summer flow rates [88, 114-8/2/72, J. Fortune]. Nevertheless, anglers are relatively successful, as indicated by the annual harvest data shown in Table 5 [75]. The bay and its major tributaries (the Siletz River, Drift Creek, and Schooner Creek) all provide good salmon

Table 5. Estimated Annual Harvest Data For Sport Fishing at Siletz Bay⁽¹⁾ [75].

| Species | area fished | annual harvest (total number) | effort (angler-days) | gross expenditures |
|-----------------------|--------------|-------------------------------|----------------------|--------------------|
| Salmon | Estuary | 4,400 | 17,600 | \$325,600 |
| | Siletz River | 1,550 | 6,200 | 114,700 |
| | Ocean | 40 | 50 | 2,960 |
| Sea-run cutthroat | Estuary | 3,440 | 16,000 | 296,000 |
| | Streams | 1,475 | | |
| Steelhead | Siletz River | 7,155 | 28,620 | 529,470 |
| Non-salmonid bay fish | Estuary | 24,000 | 8,000 | 48,000 |

¹Average of data from past years.

and trout angling [88,155]. Sea-run cutthroat can generally be caught from July to late fall with the big chinook entering the estuary in August and providing their best fishing in September. Late in September the coho enter and peak in October and November[58]. Species other than salmon and trout which are most frequently caught in the estuary, as determined in the FCO study from March to October 1971, include staghorn sculpin, shiner perch, and dungeness crab by shore angling; dungeness crab, starry flounder, and relatively few staghorn sculpin by boat angling; and ghost shrimp and some mud shrimp by clamming [38].

There are two Siuslaw National Forest camps in the watershed--one on Schooner Creek and the other on North Creek. The one on Schooner Creek is located at a point about 7 miles from the bay where the creek is formed by North Fork and South Fork. North Creek's campsite is near its mouth, which is at mile 10.2 of Drift Creek [114-7/5/72, W. Jones, 83, 26].

Boat landings on the Siletz River number about nine between the mouth and mile 16.5 [88,94].

Hunter days in the Siletz Bay area are estimated at 530 annually [114-8/2/72, G. Hatten].

Siletz Bay

Table 6. Surveillance stations at Siletz Bay.

| type of station | name and/or identifying number | approximate location | drainage area (sq mi) | period of record | references |
|------------------------|--------------------------------------|---|-----------------------|--|----------------------|
| stream gaging | Euchre Creek near Siletz; USGS #3060 | Euchre Creek; mile 1; 29 miles from the estuary mouth | 13.4 | 1924 | [88] |
| | Siletz River at Siletz; USGS #3055 | Siletz River; mile 42.6 | 202 | 1905*(1970) | [88,98] ¹ |
| DEQ water surveillance | #1 | adjacent to dock at Taft | | 7/69-(4/72) (4 measurements) | [67,68] ² |
| | #2 | opposite Cutler City | | " | " |
| | #3 | 1.5 miles downstream from Highway 101 bridge at Kernville | | " | " |
| | #4 | Highway 101 bridge at Kernville | | " | " |
| | #5 | Siletz River opposite sunset Landing (4 miles above Highway 101 bridge) | | " | " |
| | #6 | Siletz River 2.5 miles above Sunset Landing | | 8/70-(4/72) | " |
| water quality | Siletz River 3 miles north of Siletz | Siletz River; mile 34 | | 1960-(1963) (spot observations) | [26] |
| | Siletz River at Siletz; USGS #3055 | Siletz River; mile 42.6 | 202 | 1911-1912 1915 (daily spot observations) | [26] |
| water temperature | " | " | " | 1947-(1962) (spot observations) | [88,138] |

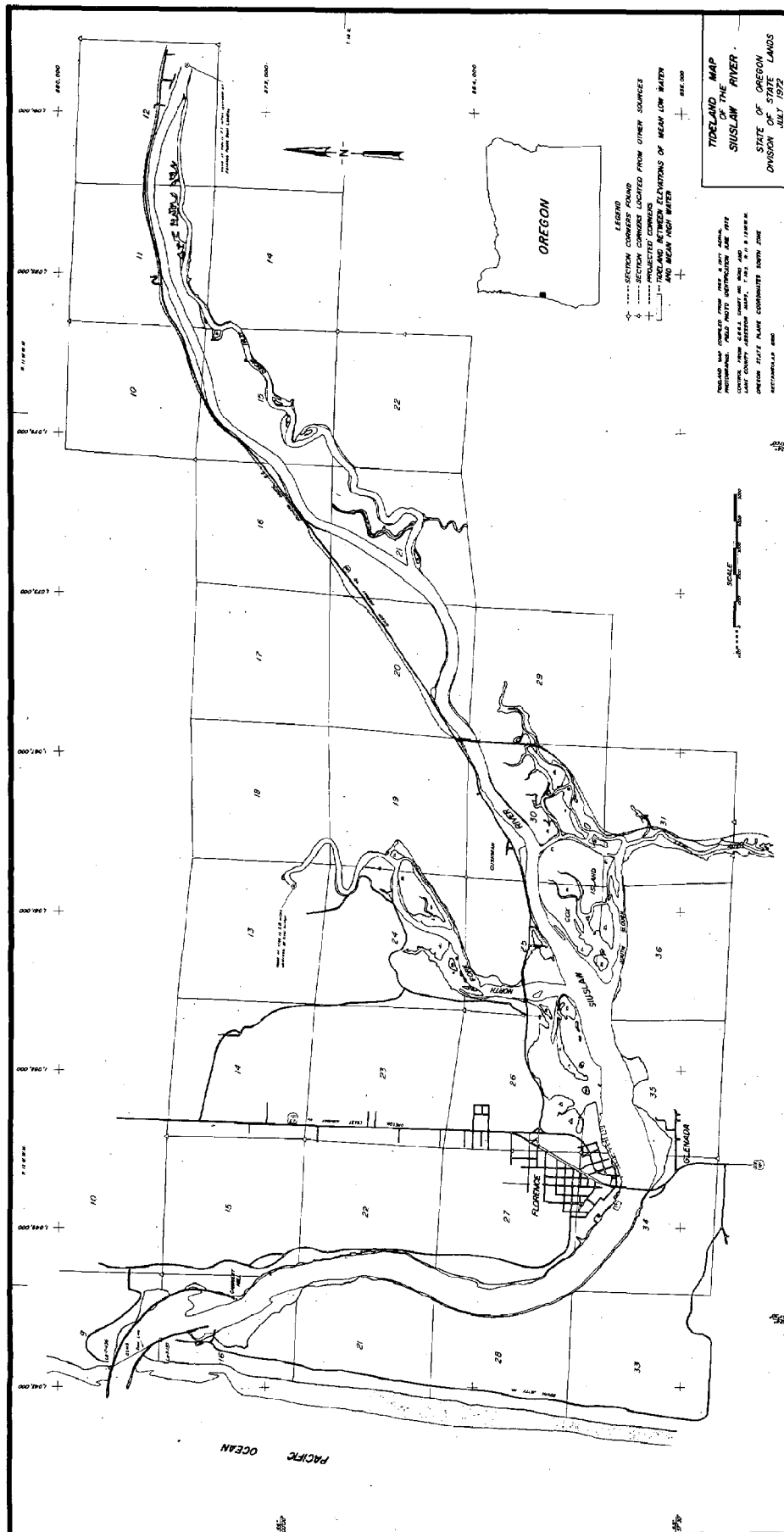
¹ Monthly and water-year runoff records have been compiled and are available in punch card or printout form through the OSWRB.

² Data available in punch card or printout form through the DEQ.

() This is the most recent record date found and is not necessarily the last.

* Period of record is not continuous.

SIUSLAW BAY



SIUSLAW BAY

General Description of Estuary and Drainage Basin

Estuary

Siuslaw Bay is located about 160 miles south of the mouth of the Columbia River. Of the estuaries included here, it ranks eighth in size (Table A). Populated areas, shown in Table 1, lie primarily on the north side of the Siuslaw River.

Table 1. Population centers at Siuslaw Bay¹ [94,111].

| name | general location | river mile location | approximate distance from estuary mouth (miles) | 1970 population |
|-----------------------|--------------------------------------|---------------------|---|-----------------|
| Florence ² | Siuslaw River; north side | 3.5 to 5.4 | 3.5 to 5.4 | 2,246 |
| Glenada | Siuslaw River; south side | 4.7 | 4.7 | 200 |
| Cushman | Siuslaw River; north side | 8.2 | 8.2 | no pop |
| Wendson | Siuslaw River; north side | 9.9 | 9.9 | no pop |
| Beck (Tiernan) | Siuslaw River; north side | 14.7 | 14.7 | 130 |
| Point Terrace | Siuslaw River; 0.5 mile to the south | 16.2 | 16.2 | not listed |
| Mapleton | Siuslaw River; north side | 20.5 | 20.5 | 900 |
| Firo | Siuslaw River | 23.9 | 23.9 | not listed |
| Brickerville | Siuslaw River; north side | 24.2 | 24.2 | 140 |
| Tide | Siuslaw River; north side | 26.5 | 26.5 | 75 |
| Siuslaw | Siuslaw River; north side | 27.8 | 27.8 | no pop |
| Swisshome | Siuslaw River; north side | 28.9 | 28.9 | 400 |
| Minerva | North Fork Siuslaw River; east side | 16.7 | 23.0 | rural |

¹Tidal effects extend approximately to mile 25 of the Siuslaw River and to mile 6.9 of the North Fork Siuslaw River.

²Incorporated

The estuary covers about 1,780 acres. Surface areas reported by Johnson [55], Marriage [59], and the Division of State Lands [70], presented in Table 2, vary from 1,458 acres to 2,245 acres. Tidelands (also given in Table 2) are extensive upstream from Florence and nearly nonexistent in the lower section of the estuary [53]. Other dimensions (distance from throat to farthest estuary shore, throat measurement; and average lagoon depth below MSL) are listed in Table 3.

Siuslaw Bay is narrow and crooked. It consists primarily of the lower reaches of the Siuslaw River, which has its zero river mile at the mouth of the estuary [94]. The river drains 773 sq mi. It has a length of 109.4 miles to its source (the confluence of the North Fork Siuslaw River¹) and

1 There are two North Fork Siuslaw Rivers.

Siuslaw Bay

Table 2. Reported surface areas of Siuslaw Bay [55,59,70].

| reference | surface area (acres) | measured at | tidelands acres | percent | submerged acres | lands percent |
|-----------|-------------------------|-----------------|--------------------|---------|--------------------|------------------|
| [55] | 1,458 1,218 978 | HW MSL LW | | | | |
| [59] | 1,589 | 1 | 597 | 38 | | |
| [70] | 2,245 1,489 | MHT MLT | 756 | 34 | 1,489 | 66 |

¹Specified by Marriage as the area affected by tidal action.

Table 3. Dimensions of Siuslaw Bay [55].

distance from throat to
farthest estuary shore--6.9 miles

inlet diemensions at throat (at MSL):
width--745 feet
average depth--23 feet
cross-sectional area--8,330 sq ft

average lagoon depth below MSL--7 feet

the South Fork Siuslaw River) and a total length (to the source of the South Fork Siuslaw River) of 117.9 miles. Between its mouth and the head of tidewater at mile 25, its major tributary is the North Fork Siuslaw River⁽¹⁾ at mile 6.3. This North Fork Siuslaw River has a length of 25.8 miles and drains 65 sq mi. Minor tributaries of the Siuslaw to tidewater at mile 25 include approximately 28 from the north (20 named) and 15 from the south (11 named) [94,88-map no. 18.6].

In addition to the port commission at Siuslaw Bay, there is also a community development corporation, both located in Florence. Their addresses and phone numbers are [106]:

Port of Siuslaw
P.O. Box 297
Florence, Oregon 97439
997-2027

Siuslaw Valley Development Corp.
P.O. Box 280
Florence, Oregon 97439
997-3486

¹ There are two North Fork Siuslaw Rivers.

Siuslaw Bay

Drainage Basin

The drainage basin of Siuslaw Bay is the same as that of the Siuslaw River--it covers 773 sq mi and yields an average of 2,300,000 ac-ft of fresh water annually [7,70,85,88]. It consists of 91% (708 sq mi) forests; 4% (28 sq mi) cropland; 1% (6 sq mi) rangeland; and 4% (31 sq mi) "other" [88].

Annual precipitation averages from 40 inches in the eastern watershed to 100 inches in the northwestern section with 80 inches along the coast [88]. Precipitation records from Florence are available through the OSWRB in punch card or printout form (Table 10) [92,143].

Elevations range from sea level to 3,000 feet [88].

Hydraulic Description of Estuary

Tides and Currents

The bay is described as being fully exposed to waves at the throat [55].

Tidewater reaches to between miles 22.5 [69] and 25 [107] of the Siuslaw River and to mile 6.9 of the North Fork Siuslaw River [69].

The mean tide range is 5.2 feet with a diurnal range of 6.9 feet and an extreme range of 11.0 feet [86]. Tidal prism on mean range is 2.76×10^9 cu ft with a diurnal range of 3.66×10^9 cu ft [55].

Currents and tidal ranges have been measured (1973) to determine the times of maximum ebb and flood flow [151].

River Discharges

Normal flow of the Siuslaw River (at the mouth) has been estimated as 3,150 cfs based on precipitation records from 1937 to 1963 [7]. A stream gaging station is located on the Siuslaw River at mile 23.7 near Mapleton (Table 10) where the drainage area is 588 sq mi. The station has been in operation since October 1967, and records through September 1970 show extreme flows of 32,300 cfs (January 27, 1970) and 70 cfs (August 30 and 31, 1970) with an average discharge during the 1969 water year of 2,023 cfs [140].

Salinity and Classification by Mixing

Burt and McAllister have reported salinity measurements taken in the Siuslaw River during October 1957 and January, March, and July 1958 for a total of four sampling dates [12]. Of the four, salinity intrusion

Siuslaw Bay

was greatest on October 7, 1957 at HHW when it reached a point 17.3 miles from the ocean at concentrations of 0.2 ppt on the surface (water temperature--14.0°C) and 0.4 ppt on the bottom at a depth of 10 feet (water temperature--13.7°C).

On the basis of salinity change from top to bottom, Burt and McAllister classified Siuslaw Bay as a two-layered system in January and May; as a partly-mixed system in March; and as a well-mixed system in October [13].

Giger [39] provides salinity measurements with depth and length for high and low tides during winter (1968) and summer (1967) conditions. Salinity intrusion was shown to approximately 20-22 miles from the ocean during summer conditions and approximately 5-7 miles from the mouth during winter conditions. The system is well mixed during the summer period particularly at high tide.

Seasonal (1973) measurements of salinity, temperature, turbidity, pH and dissolved oxygen have been taken for high and low tides with depth and length within the estuary [151].

Sediments

It is estimated that the Siuslaw River transports some 103,000 tons of sediments to the estuary annually [57,85]. A water temperature station is located on the Siuslaw River at mile 23.7 (near Mapleton) and records of sediment concentrations and sediment loads are kept there (Table 10) [141]. Daily extremes of sediment concentration during the period from August 1967 through September 1968 were 1 mg/l (many times) and 160 mg/l (February 1968). The daily sediment load ranged from 0.36 tons (August 1967) to 4,600 tons (February 1968). A major source of coarse grain sediments in the estuary is the sand dunes to the south. Some material is transported by the wind with a degree of counteraction by the high current velocities which result from the narrow channel; however, all but the main channel in the lower reaches of the estuary has been filled [53].

Analyses of 6 U.S. Army Corps of Engineers dredge samples taken primarily from the entrance channel during the early 1960's and 1970's show the following: (1) organic contents ranging from 0.26% (April 1972) to 0.61% (August 1971); (2) void ratios ranging from 0.551 (August 1971) to 0.809 (August 1962), and (3) mean grain size consistently that of fine sand [124].

Analysis of sediments for grain size, porosity and volatile solids along the length of the estuary have been determined for summer and winter (1973) conditions [151].

Siuslaw Bay

Water Quality Information

The DEQ operates nine water surveillance stations on Siuslaw Bay (Table 10) [67,68]. Records are available in punch card or printout form for as far back as June 1968 with at least seven sampling dates at most of the stations.

The USGS water temperature station located on the Siuslaw River at mile 23.7 (Table 10) recorded an average temperature for November 1967 through August 1968 (10 months) of 12°C and extremes for the period of 26°C (in July 1968) and 3°C (in December 1967 and January 1968) [141].

Florence city water is pumped from the sand dunes [35]. The city operates a secondary treatment sewage plant located in the southwest section of Florence on Rhododendron Drive about 4.5 miles west of Highway 101. Average daily flow from the plant during October 1972 (fairly dry weather) was about 350,000 gallons. The plant serves Florence only (no industries) and is the only sewage treatment plant on the bay [36,121].

Biological Information

The number of adult anadromous salmonids spawning in the Siuslaw River system are estimated as follows: spring chinook--0, fall chinook--4,500, coho--22,000, summer steelhead--0, winter steelhead--13,000, and sea-run cutthroat--50,000 [75]. A comparison with the number of salmonids spawning in other estuarine river systems (Table B) shows these figures to be below average.

Species commonly found in the bay which are of interest to anglers include salmon, redbait seaperch, bay mussels, pile perch, dungeness crab, and softshell clams (found mainly in the tidelands upstream from Florence). Less common (but still fairly abundant) are shiner perch, staghorn sculpin, piddocks, and gaper clams (in a small bed near the mouth of the bay) [38,53,155].

The area around the estuary is a winter range for black-tailed deer, Roosevelt elk, black bear, and cougar. Of these, black-tailed deer are the most abundant [75].

Physical Alterations

Modifications to the estuary by the U.S. Army Corps of Engineers as originally planned included an entrance channel stabilized by two rubble-mound jetties and leading to a river channel which was to extend approximately 7.5 miles up the Siuslaw River. In 1958, expansion of many portions of the project plus a turning basin near Florence were authorized. A summary of the alterations is given in Table 4.

Siuslaw Bay

The Siuslaw River is navigable to mile 19.0, and the North Fork Siuslaw River is navigable by small craft to mile 2.0 (controlling depth 3 feet) [69].

Army Corps of Engineers dredging records for 1959 through 1969 (excluding 1968) show most of their dredging activities taking place in the entrance channel with the 82,300 cu yds removed from there in 1965 being a fairly typical quantity [55]. The maximum amount was 822,080 from the "16-foot channel" in 1969 and the minimum amount was 48,250 cu yds from the entrance channel in 1965.

Private contractors have performed hydraulic dredging on the North Fork Siuslaw River and have spoiled behind berms [50].

The inventory of filled lands in the Siuslaw River taken by the Division of State Lands shows that land fills on submerged or submersible lands are located nearly exclusively in the Florence area [69]. As of June, 1972, these fills totaled 40.75 acres of which 36.28 acres were dredging spoils (Table C). Considerable modification of marshes has occurred in the past through agricultural uses.

Table 4. U.S. Army Corps of Engineers Modifications to Siuslaw Bay [55,126,128,129].

| Proposed Modification | Location | Dimensions | | | (1) Date and Status |
|-----------------------|--|-----------------|----------------------------|------------|---|
| | | depth (feet) | width (feet) | Length | |
| North Jetty | entrance | | | | 1917-completed 1958-rehabilitated 1958 ⁽²⁾ -600-foot extension authorized |
| South Jetty | Entrance | | | | 1917-completed 1962-rehabilitated |
| Channel | Entrance | 12 | | | 1930-completed |
| | | 18 | 300 | 1,500 feet | 1958 ⁽²⁾ -expansion authorized 1969-deepened |
| Channel | Entrance to Florence | 12 | 200 | 5 miles | 1930-completed |
| | | 16 | 200 (wider at bends) | 5 | 1958 ⁽²⁾ -expansion authorized 1968-dredging completed |
| Turning Basin | Opposite Siuslaw dock at Florence | 16 | 400 | 600 feet | 1958 ⁽²⁾ -authorized |
| Channel | Florence to Cushman | | 150 | 2.5 miles | 1930-completed |

¹Lack of completion date does not necessarily signify that the modification has not been constructed.

²Preconstruction planning for the 1958 authorization reportedly underway as of 1971 (publication date) unless otherwise indicated [129].

Siuslaw Bay

Table 5. Major water-related businesses on the Siuslaw River within tidewater (mile 25) [107].

| name | distance from mouth ¹ (miles) | type of business | number employed | log raft storage (acres) |
|--|--|----------------------------|--------------------|--------------------------------|
| U.S. Coast Guard Station, Siuslaw R. | 1.9 | | 20 | |
| Siuslaw Pacific Moorage | 2.5 | | 4 - 6 | |
| Bay Bridge Marina | 4.9 | | 2 - 4 | |
| Port of Siuslaw main dock | 5.3 | | 8 - 12 | |
| commercial marina | | | 1 - 2 | |
| sport boat marina | | | 1 - 2 | |
| Umpqua River Navigation Riverside Machine Shop T. O. Nordahl | 6.9 | | 4 - 8 | |
| The Murphy Company | 7.8 | veneer mill peeler logs | 40 - 60 | 2 |
| Siuslaw Marina and Boatways | 8.1 | | 1 - 3 | |
| Nordahl Tow Boat Co. | 8.4 | | 3 - 6 | |
| Cushman Store and Marina | 8.5 | | 1 - 2 | |
| Will's Shingle Mill | 10.8 | shingle mill | 2 - 6 | 0.25 to 0.5 |
| Midway Docks | 11.4 | | 1 - 3 | |
| Porters Landing | 14.9 | | 1 | |
| C & D Docks | 15.4 | | 1 - 2 | 10 to 15 ² |
| Davidson Industries, Inc. | 16.1 | lumber mill | 172 | |
| Russels Marina | 17.9 | | 1 - 2 | |
| U.S. Plywood Corp. | 19.2 | plywood mill | 150 - 200 | 2 to 3 ³ |

¹All located on the north side of the Siuslaw River except Russels Marina on the south.

²Has cut back almost 35% of water storage in the last year; 10 to 15 acres is the present use.

³No storage--only barked peelers put into water prior to use, utilizing 2 to 3 acres.

Siuslaw Bay

Estuary Uses

Industrial and Commercial

Incomes in the Siuslaw Basin are derived primarily from the forests. The estuary is used for log storage, towing, and barging, and numerous forest products are made in the area and shipped from the Port of Siuslaw each year [35,49,129,155].

The 16 major water-related businesses on the Siuslaw River (to Tidewater at mile 25) are listed in Table 5. Of the 16, four deal in forest products and have a combined work force of about 400 as opposed to approximately 60 for the remaining 12. These four industries use from 14.25 to 20.5 acres of the estuary (depending on the time of year) for log storage (also shown in Table 5) [107]. Manufacturers in the area other than those on the Siuslaw River listed in Table 5 are described in Table 6 [71]. Most of these deal in lumber or wood products.

Table 6. Major Manufacturers at Siuslaw Bay not Included in Table 5 [71].

| Location | Name | Type of Business | Number Employed |
|----------|--|---|-----------------|
| Florence | Siuslaw News and Printing | newspaper and commercial print and magazine printing | 10 |
| | 10 other manufacturers employing less than 10 | dealing mainly in lumber and wood products (mostly logging) | |
| Mapleton | Lagler Logging Inc. | Contract logging | 20 |
| | 3 manufacturers, 2 of which employ 1 (the other is not listed) | dealing in logging | |

Forest products account for virtually all traffic on the Siuslaw River project. Of the 127,000 tons of traffic using the river during 1969, about 75% was lumber and nearly 25% rafted logs. Annual traffic between 1960 and 1969 averaged 207,000 tons [155], and water shipment of forest products by the Port of Siuslaw is about 125 tons each year [35]. Much of this is sent to the San Francisco Bay area, Los Angeles, and the Hawaiian Islands.

Siuslaw Bay

Commercial fishing from the estuary, mainly for shad and crab, is quite limited (Table 7). Landings from the entire area provide some

Table 7. Commercial Harvest of Shad, Striped Bass, and Crabs From Siuslaw Bay.

| Species | 1969 | | 1970 | | 1971 | |
|-----------------------------|-----------------------|------------------------|----------------------|-----------------|----------------------|-----------------|
| | pounds landed | fishermen value | pounds landed | fishermen value | pounds landed | fishermen value |
| Shad ⁽¹⁾ | 10,266 | \$1,000 | 9,520 | \$1,000 | 8,290 | \$1,000 |
| Striped Bass ⁽¹⁾ | | | 629 | | 1,242 | |
| Crabs | 12,000 ⁽²⁾ | \$3,000 ⁽²⁾ | 3,320 ⁽³⁾ | | 3,800 ⁽³⁾ | |

¹Source of reference [20]; data for the Siuslaw River System.

²Source of reference [75]; data for Siuslaw Bay.

³Source of reference [118]; data for Siuslaw Bay.

income (Table 8), although not as much as at most of the other estuaries included here (Tables D and E) [34].

There are some agricultural activities (dairy and row crop farming) [35], and the area upstream from the estuary is becoming more industrialized [155].

Table 8. Commercial Harvest of Food Fish Received at Florence, 1971⁽¹⁾ [34].

| Species | Harvest (pounds round weight) | Fishermen value |
|---------------|----------------------------------|--------------------|
| Crabs | 134,213 | \$40,000 |
| Coho | 133,395 | 42,000 |
| Albacore Tuna | 12,003 | 4,000 |
| Shad | 8,290 | 1,000 |
| Chinook | 6,898 | 4,000 |
| Groundfish | 2,293 | — |
| Striped Bass | 1,242 | — |
| Smelt | 40 | — |
| Totals | 289,374 | \$91,000 |

¹Includes 1971 data presented in Table 7.

Siuslaw Bay

Table 9. Estimated Annual Harvest Data for Sport Fishing at Siuslaw Bay¹ [75].

| Species | area fished | annual harvest (total number) | effort (angler-days) | gross expenditures |
|--------------------------|------------------|----------------------------------|-------------------------|-----------------------|
| Salmon | Estuary | 4,600 | 11,000 | 340,400 |
| | Siuslaw River | 2,000 | 4,000 | 148,000 |
| | Ocean | 11,000 | 14,000 | 814,000 |
| Sea-run cutthroat | Estuary River | 14,000 | 20,000 | 370,000 |
| | | 2,000 | | |
| Steelhead | River | 4,000 | 12,000 | 296,000 |
| Shad | Estuary | 300 | 200 | 3,700 |
| Striped Bass | Estuary | 100 | 600 | 11,100 |
| Non-salmonid bay fish | Estuary | 12,000 | 10,000 | 60,000 |

¹Average of data from past years.

Recreational

Annual harvest data for angling at Siuslaw Bay are given in Table 9.

Trolling for coho, chinook, and sea-run cutthroat in the estuary is popular from mid July through November with the best salmon fishing occurring soon after the first heavy rain in September. During the winter months, casting for steelhead is popular [35,58].

Species other than salmon and trout which are most commonly taken from the estuary (as determined in the FCO study from October to March 1971) are redbait seaperch, bay mussels, and pile perch by shore angling; dungeness crab and relatively few shiner perch and staghorn sculpin by boat angling; and soft shell clams, relatively few piddocks, and a limited number of mussels by clamming [38].

Marinas on the estuary include the Bay-Bridge Marina, Port of Siuslaw, and Siuslaw Pacific Moorage [35].

Siuslaw Bay

Table 10. Surveillance stations at Siuslaw Bay.

| type of station | name and/or identifying number | approximate location | drainage area (sq mi) | period of record | references |
|------------------------|--|--|-----------------------|----------------------------------|--------------------------|
| climatological | Florence 3 NNW | Siuslaw River; mile 10 | | 1909*(1963) | [88,92,143] ¹ |
| | Mapleton | Siuslaw River; mile 21 | | 1924-1929 | [88] |
| stream gaging | Siuslaw River near Mapleton | Siuslaw River; mile 23.7 | 588 | 1967-(1970) | [140] |
| | Siuslaw River above Wildcat Creek near Austa; USGS #3070 | Siuslaw River; mile 44.9 | 267 | 1931-1941 | [98] ² |
| | North Fork Siuslaw River near Minerva | North Fork Siuslaw River; mile 13.09 | | | [140] |
| DEQ water surveillance | #1 | red channel buoy #16 | | 6/68-(12/71) (7 measurements) | [67,68] ³ |
| | #2 | red channel buoy #32 | | " | " |
| | #3 | channel, 250 yards below Highway 101 bridge-- buoy #47 | | " | " |
| | #4 | 200 yards north and 700 yards east of Highway 101 bridge | | " | " |
| | #5 | black channel buoy #55 | | 6/68-(12/71) (6 measurements) | " |
| | #6 | North Fork Siuslaw River bridge | | 6/68-(12/71) (7 measurements) | " |
| | #7 | main channel near Cushman | | " | " |
| | #8 | South Slough inlet next to Siboco | | 6/68-(12/71) (6 measurements) | " |
| | #9 | Beck station Tiernan; 4 miles above Cushman | | 6/68-(12/71) (7 measurements) | " |
| water temperature | Siuslaw River; near Mapleton | Siuslaw River; mile 23.7 | 588 | 1967-(1968) | [141] ⁴ |

¹Precipitation data available in punch card or printout form through the OSWRB.

²Monthly and water-year runoff records have been compiled and are available in punch card or printout form through the OSWRB.

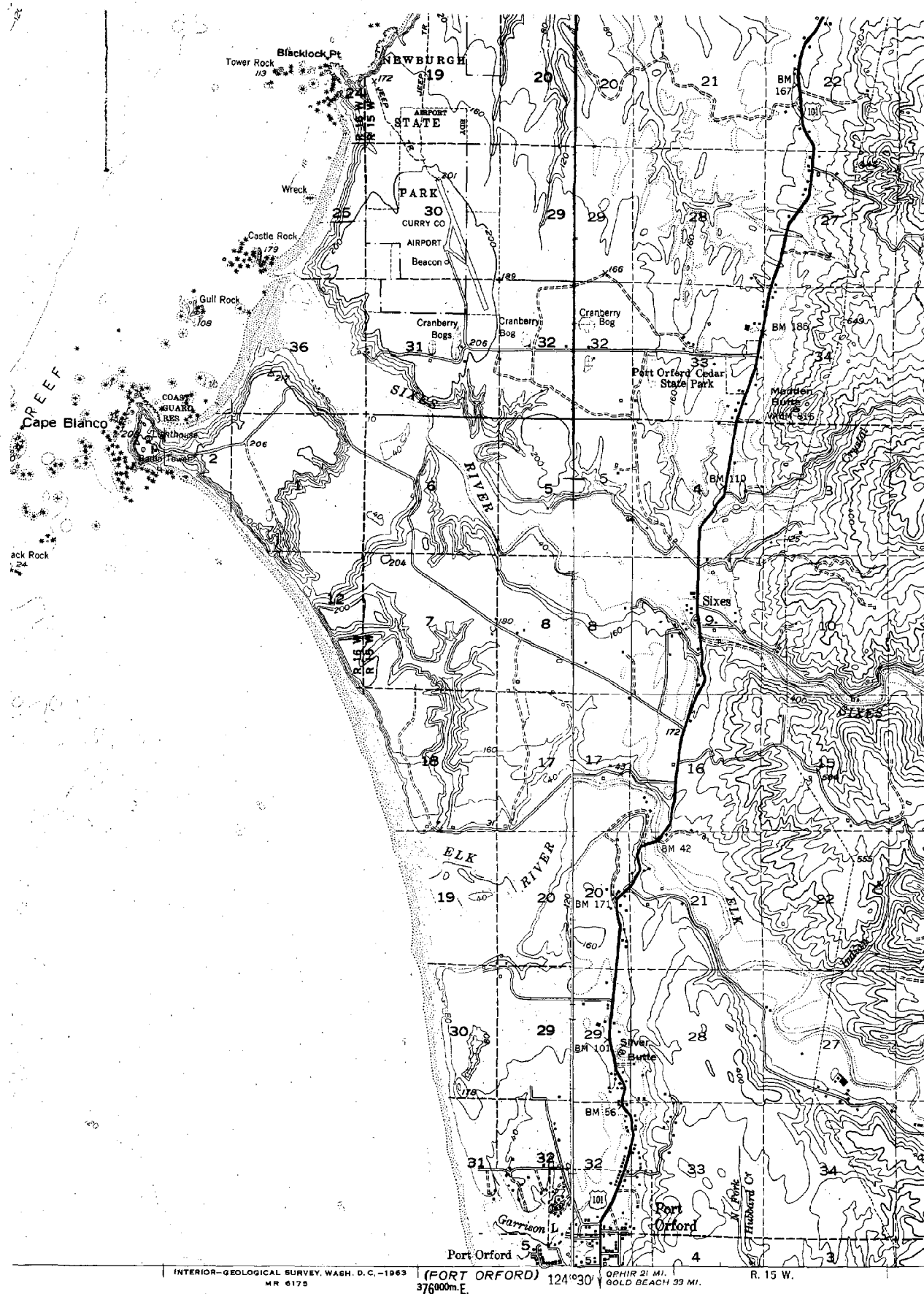
³Data available in punch card or printout form through the DEQ.

⁴Includes sediment records.

() This is the most recent record date found and is not necessarily the last.

* Period of record is not continuous.

SIXES RIVER



SIXES RIVER

General Description of Estuary and Drainage Basin

Estuary

The Sixes River Estuary lies 233 miles south of the Columbia River mouth. It ranks as one of the smallest in size in terms of surface area. Population in the area is largely rural, the small town of Sixes being near the river and Port Orford approximately 5 miles to the south. Census figures and locations appear in Table 1.

Table 1. Population Centers at Sixes River [9,96,111,154].

| Name | General Location | River Mile Location | 1970 Population |
|----------------|---------------------------------|---------------------------|--------------------|
| Sixes | Sixes River, N. Side | 5.3 | (not listed) |
| Port Orford | 5 miles south of Sixes, Ore. | not applicable | 1,037 |

The HW surface area of the estuary as estimated from 1973 EROS Data Center aerial photographs is 330 acres [135].

The average annual yield of the Sixes River at its mouth was 440,000 ac-ft for the period of 1930-1961. The minimum annual yield was 240,000 ac-ft, and the maximum, 630,000 ac-ft. The Sixes River source is at river mile 31.4, elevation 880 feet [93,96].

The Port of Port Orford is located at P.O. Box 227, Port Orford, Oregon 97465; telephone number 332-3281 [106].

Drainage Basin

The Sixes River drains a total basin area of 129 sq. miles. The average yearly freshwater yield of the Sixes River is 440,000 ac-ft which equals an average annual yield of 64 inches over the basin [93].

The Sixes River Basin consists primarily of woodlands (92.3%; 76,765 acres), cropland (1.9%; 1,565 acres), and pasture (4.3%; 3,610 acres). As of January, 1963 the Sixes River had one existing storage pond and 3 potential reservoir sites being studied.

The Sixes stream profile appears on page 43 in the Chetco River Basin section.

SIXES RIVER

General Description of Estuary and Drainage Basin

Drainage Basin

The average annual precipitation ranges from 60 inches at the mouth of the Sixes River to 110 inches in the upper reaches [93].

There are four climatological stations in the vicinity. The Cape Blanco station has precipitation and temperature data from 1952, the Langlois station has precipitation and temperature data from 1891-1904, the Langlois 2 station has precipitation data from 1922, and the Port Orford station has precipitation and temperature data from 1852-1856 and from 1905 to the present [93,143].

The Sixes River has a length of 31.4 miles, the South Fork having a length of 8 miles. The elevation drop from source to mouth is 880 feet for the Sixes River and 1,840 feet for the South Fork. The average gradient for the Sixes River is 28 feet per mile and 230 feet per mile for the South Fork [93].

Hydraulic Description of Estuary

Tides and Currents

According to the U.S. Geological Survey, the average range of the tide is approximately 5 feet [144].

River Discharges

Stream flow records are available from the USGS stream gaging station on the Sixes River at Sixes, Oregon. The station is located at river mile 5.3. The station is discontinued, but records are available for data taken between October 1967 to June 1970. Stream flow averages and extremes appear in Table 2 [148].

Table 2. Stream Gaging Data [148].

| Stream | Location (river mile) | Drainage area (sq.mi.) | Complete water years of record | Flowrate (cfs) | | |
|----------------|--------------------------|------------------------------|--------------------------------------|-------------------|------|------|
| | | | | max. | min. | mean |
| Sixes River | 5.3 | 116 | Oct; 1967 to June, 1970 | 23,800 | 18 | 646 |

SIXES RIVER

Hydraulic Description of Estuary

Salinity and Classification by Mixing

Salinity profiles as a function of depth and distance from the mouth of the river are presented in Table 3. Data was taken on August 22, 1973 during a high tide of +7.5 feet [87].

Sediments

North of Cape Blanco the shoreline is dominated by marine terraces with low cliffs and narrow, sand beaches. The narrow beaches in the area are composed of coarse sands and gravels. The shoreline between Floras Lake and Cape Blanco displays rocky headlands with steep cliffs.

According to the National Shoreline Study by the U.S. Army Corps of Engineers (Aug., 1971), the beach area at Floras Lake north of the Sixes River Estuary is experiencing non-critical erosion along with the shoreline at Cape Blanco to the south of the estuary. The beaches in the immediate vicinity of the estuary are experiencing no erosion [125].

The generalized sediment yield for streams in the area is 0.1 to 0.5 ac-ft per sq. mile per year [23].

Water Quality Information

Miscellaneous flow and temperature measurements for the basin were made by the Oregon State Game Commission. Temperature ranges from these sources are presented in Table 4 [78].

DEQ water quality stations are listed in Table 7.

Biological Information

Estimates of the number of adult anadromous salmonids spawning in the Sixes River system are as follows: spring chinook--none, fall chinook--3,000, coho--300, steelhead--2,500, sea-run cutthroat--3,000. The Sixes River is considered to be one of the most important fall chinook streams on the Oregon Coast [78,93].

Dace, cottids, red-sided shiners, sticklebacks, lamprey, and suckers are the known rough fish species in the stream systems of the South Coast Basin [78].

The most important factor limiting fish production in the South Coast Basin is summer water supply. The Sixes River system contains extensive porous gravel beds through which summer flows frequently sub-out, resulting in considerable fish loss (Table 5) [78].

Sixes River

Biological Information

Table 3. Salinity Values for Sixes River Estuary. Aug. 22, 1973 [87].

| Station | Distance from mouth (mi.) | Salinity % | | Depth (ft.) |
|---------|------------------------------------|------------|--------|----------------|
| | | top | bottom | |
| 1 | 0.1 | 28.5 | 28.5 | 2 |
| 2 | 0.2 | 22.7 | 26.9 | 4 |
| 3 | 0.3 | 18.8 | 27.2 | 5 |
| 4 | 0.4 | 22.1 | 27.9 | 6 |
| 5 | 0.5 | 3.1 | 27.9 | 6 |
| 6 | 0.7 | 2.7 | 27.2 | 4 |
| 7 | 0.9 | 2.8 | 27.2 | 3 |
| 8 | 1.0 | 2.9 | 27.2 | 3.5 |
| 9 | 1.3 | 2.8 | 19.5 | 2 |
| 10 | 1.4 | 1.7 | 26.0 | 5 |
| 11 | 1.9 | --- | ---- | 1 |

Water temperatures over 70°F commonly accompany low summer flows. Low natural summer runoff coupled with extensive streamside logging in the Sixes basin contribute to warm streamflow conditions during the summer. (See Table 4) [78].

Logging and related road construction are the main causes of siltation. Naturally--occurring landslides and poor land development are other causes. Heavy deposition of silt is more likely to occur on spawning beds and food producing areas when stream flows are low and unable to keep the particles in suspension. The Sixes system is one of five areas in the South Coast Basin considered to be most affected by siltation [78].

Table 4. Temperature Extremes for Sixes Drainage Basin [78].

| Point of measurement | Period of record | Observed Temperature Extremes (F°) | | type of observation |
|---------------------------------------|-------------------|------------------------------------|------|---------------------|
| | | max. | min. | |
| Sixes River river mile 5 | 4-8-69 to 7-22-69 | 71 | 54 | spot |
| Sixes River above Dry Cr. | 4-8-69 to 7-22-69 | 74 | 52 | spot |
| Sixes River below Middle Fork | 4-8-69 to 6-4-69 | 70 | 49 | spot |
| Sixes River below North Fork | 4-8-69 to 6-4-69 | 69 | 45 | spot |
| Sixes River above Hays Cr. | 4-8-69 to 5-7-69 | 49 | 44 | spot |
| Crystal Cr. mouth | 4-8-69 to 7-22-69 | 67 | 54 | spot |
| Edson Cr. mouth | 4-8-69 to 7-22-69 | 68 | 50 | spot |
| Dry Cr. 100 yd. above mouth | 4-8-69 to 7-22-69 | 55 | 51 | spot |
| Elephant Rock Cr. 100 yd. above mouth | 4-8-69 to 5-7-69 | 58 | 52 | spot |
| S. Fork Sixes R. 100 yd. above mouth | 4-8-69 to 7-22-69 | 65 | 47 | spot |
| Otter Cr. 50 yd. above mouth | 4-8-69 to 5-7-69 | 59 | 51 | spot |
| Mid. Fork Sixes R. below Cold Cr. | 4-8-69 to 6-4-69 | 64 | 46 | spot |
| Sugar Cr. 200 yd. above mouth | 4-8-69 to 5-7-69 | 52 | 48 | spot |
| N. Fork Sixes R. river mile 0.7 | 4-8-69 to 6-4-69 | 68 | 45 | spot |
| Hays Cr. 100 yd. above mouth | 4-8-69 to | 50 | 44 | spot |

SIXES RIVER

Biological Information

Table 5. Dry Creek (Sixes River) Fish Salvage Results, 1949-1952 [78].

| YEAR | NUMBER OF FISH SALVAGED* |
|-------|--------------------------|
| 1949 | 20,125 |
| 1950 | 37,454 |
| 1951 | 47,673 |
| 1952 | <u>32,330</u> |
| TOTAL | <u>137,582</u> |

* Steelhead, coho, salmon, and fall chinook salmon.

Logjams and natural falls create the only significant barriers to fish passage in the South Coast Basin. The Sixes system is one of five areas in the basin considered to be most adversely affected by logjams [78].

The Sixes River system has 13 streams used by adult anadromous salmonids, 11 of which have minimum flow recommendations established and 1 protected by the State Water Resources Board. It has been recommended that the entire stream of Dry Creek (Sixes R.) above river mile 0.25 should be protected from gravel removal [78].

Table 6 refers to the estimated sport harvest in the Sixes River system.

Many of Oregon's important bottom fish and shellfish, as well as all anadromous salmonids, depend on the estuarine environment during some part of their lives. Due to the geology of the extreme southern Oregon Coast, the estuaries in this region are generally small in size. However, these estuaries, including the Sixes River Estuary, are important for the survival of salmon and steelhead [78].

Figure 1 is a periodicity chart showing when adult spawning anadromous fish are present in the Sixes River System.

Figure 1. Periodicity Chart for Adult Spawning
Anadromous Fish in the Sixes River System [78].

Chinook Salmon *****

Coho Salmon -----

Steelhead and
Cutthroat trout :::::::::::::::

| Stream | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | April | May |
|-------------------------|-------|------------|------------|------------|------------|------------|------------|------------|
| Sixes River | ***** | ***** | ***** | ***** | ***** | | | |
| | | ----- | ----- | ----- | ----- | | | |
| | | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: |
| Dry Creek | ***** | ***** | ***** | ***** | ***** | | | |
| | | ----- | ----- | ----- | ----- | | | |
| | | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: |
| Edson Creek | ***** | ***** | ***** | ***** | ***** | | | |
| | | ----- | ----- | ----- | ----- | | | |
| | | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: |
| Elephant Rock Creek | ***** | ***** | ***** | ***** | ***** | | | |
| | | ----- | ----- | ----- | ----- | | | |
| | | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: |
| Otter Creek | ***** | ***** | ***** | ***** | ***** | | | |
| | | ----- | ----- | ----- | ----- | | | |
| | | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: |
| Sixes River, Mid. Fork | ***** | ***** | ***** | ***** | ***** | | | |
| | | ----- | ----- | ----- | ----- | | | |
| | | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: |
| Sixes River, North Fork | ***** | ***** | ***** | ***** | ***** | | | |
| | | ----- | ----- | ----- | ----- | | | |
| | | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: |
| Sixes River, South Fork | ***** | ***** | ***** | ***** | ***** | | | |
| | | ----- | ----- | ----- | ----- | | | |
| | | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: |
| Sugar Creek | | | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: | :::::::::: |

SIXES RIVER

Biological Information

Table 6. Estimated Annual Harvest, Angler Days, and Gross Expenditures for Angling in the Sixes River System [78].

| Fish | Harvest | Angler Days | Gross Expenditures |
|-------------------|---------|-------------|--------------------|
| Salmon * | 2,600 | 10,400 | \$192,400 |
| Steelhead | 1,200 | 4,800 | 88,800 |
| Sea-run Cutthroat | 450 | <u>250</u> | <u>4,625</u> |
| TOTAL | | 15,450 | \$285,825 |

* Includes jack salmon.

Big game create the most hunting opportunities of all wildlife in the basin. In order of abundance, they are: black-tailed deer, Roosevelt elk, black bear, and cougar. Upland game animals include: band-tailed pigeon, ruffed grouse, blue grouse, mourning dove, mountain quail, valley quail, pheasant, and silver-grey squirrel. Waterfowl use of the Sixes area is relatively minor, but can provide some good to excellent shooting at times in certain areas. Species sighted are mallard, pintail, widgeon, coot, ruddy duck, canvasback, green-winged teal, gadwall, readhead, ringnecked duck, scaup, and merganzers.

Furbearers trapped most frequently are beaver, muskrat, river otter, raccoon, and mink. The ring-tailed cat (Bassariscus) and sea otter are the most unique animals in the area and have received full protection by the Game Commission [78].

Physical Alterations

The only physical alteration near the estuary is the Oregon Coast Highway Bridge (U.S. 101) at river mile 5.4 [96].

SIXES RIVER

Estuary Uses

Industrial and Commercial

The only known industrial and commercial uses for the Sixes River are irrigation, mining, and gravel removal. The legal annual depletion is 1,700 ac-ft with the estimated actual annual consumption being 400 ac-ft. The Sixes River has 2 reservoir rights issued for industrial purposes with a total of 464 ac-ft storage capacity and a total surface area of 39 acres. Surface water rights include 3.12 cfs consumptive for domestic, irrigation, and industrial use, while 75 cfs nonconsumptive rights are issued for mining purposes. Chromite, gold, platinum, and coal are mined in the watershed [93].

The only manufacturer in Sixes, Oregon is the Lester T. Smith Lumber Co., a logging contractor which has one employee [71].

Recreation

The principal attraction of the basin is the Pacific Ocean, and the 145 miles of shoreline are dotted with state parks, waysides, and tourist facilities. Fishing, boating, and other water-based sports make extensive use of the basin's stream system. The large forest areas covering the slopes of the Coast Range provide excellent hunting.

Parts of the Sixes River flow through the northern portions of the Siskiyou National Forest. Several streams in the basin have outstanding aesthetic values and make a significant contribution simply because they maintain attractive flows, have little stream-side development, and possess watersheds that have not been excessively logged. The entire South Fork of the Sixes River was selected by the Oregon State Game Commission as a stream which should be managed for its aesthetic value [78,93].

Table 7. Surveillance Stations at Sixes River

| Type of station | Name and/ or identifying number | Approximate location | Drainage area (sq.mi.) | Period of record | Reference |
|-----------------|---|-----------------------|------------------------|-------------------------|-----------|
| Climatological | Cape Blanco | T32S, R16W Sec. 2 | | 1952-present | [93] |
| " | Langlois | T30S, R15W Sec. 35 | | 1891-1904 | " |
| " | Langlois 2 (Formerly Denmark, Willow Creek) | T13S, R15W Sec. 2 | | 1922-present | " |
| " | Port Orford (Formerly the heads) | T33S, R15W Sec. 8 | | 1852-1856, 1905-present | " |
| Stream Gaging | 14327150 At Sixes, Oregon | T32S, R15W Sec. 9 | 116 | Oct., 1967-June, 1970 | [148] |
| Water Quality | Sixes R. 1 mi. above HWY 101 Bridge river mile 7.2 | T32S, R15W Sec. 10 | | | [148] |

TILLAMOOK BAY

TILLAMOOK BAY

General Description of Estuary and Drainage Basin

Estuary

Tillamook Bay, the second largest of the estuaries included in this report, lies about 50 miles south of the mouth of the Columbia River. Three incorporated towns in the area are Garibaldi, Bay City, and Tillamook. These and other population centers are listed with their 1970 census figures and approximate locations in Table 1. Not included in Table 1 are the U.S. Coast Guard Station to the north of the estuary mouth and the U.S. Naval Air Station about 1 mile southeast of mile 5 of the Trask River.

Table 1. Population centers at Tillamook Bay¹ [95,111,89-map].

| name | general location | approximate distance from estuary mouth (miles) | 1970 population |
|------------------------|--|---|-----------------|
| Barview | Tillamook Bay; north side at the mouth | 0 | 55 |
| Garibaldi ² | Tillamook Bay; north side | 1 | 1,083 |
| Miami | Tillamook Bay (Miami Cove); north side | 3 | not listed |
| Hobsonville | Tillamook Bay; north side (east of Miami Cove) | 2 | not listed |
| Bay City ² | Tillamook Bay; east side | 4 | 898 |
| Idaville | Tillamook Bay; 1 mile to the east | | 250 |
| Juno | Tillamook Bay; 1 mile to the east | | no pop |
| Cape Meares | Tillamook Bay (Briggs Cove); west side | 3.5 | 50 |
| Tillamook ² | Trask River; north side; mile 2 | 9.5 | 3,968 |
| South Prairie | Tillamook River; north side; mile 6.9 | 14.5 | not listed |
| Pleasant Valley | Tillamook River; east side; mile 11.3 | 18.8 | rural |

¹Tidal effects extend approximately to mile 1.3 of the Kilchis River, mile 0.4 of the Miami River, mile 7.0 of the Tillamook River, mile 4.2 of the Trask River, and mile 2.4 of the Wilson River.

²Incorporated

Tillamook Bay is about 6 miles long and 2 miles wide. An average of the surface areas reported by Johnson at HW [55], Marriage [59], and the Division of State Lands at MHT [70] is approximately 8,660 acres

Tillamook Bay

of which 50% to 60% is tidelands (Table 2). Other dimensions as given by Johnson are shown in Table 3.

Table 2. Reported surface areas of Tillamook Bay [55,59,70].

| reference | surface area (acres) | measured at | tidelands | | submerged acres | lands percent |
|-----------|-------------------------|--------------|-----------|---------|--------------------|------------------|
| | | | acres | percent | | |
| [55] | 8,861 | HW | | | | |
| | 6,589 | MSL | | | | |
| | 4,339 | LW | | | | |
| [59] | 8,839 | ¹ | 5,147 | 58 | | |
| [70] | 8,289 | MHT | 4,163 | 50 | 4,127 | 50 |
| | 4,126 | MLT | | | | |

¹ Specified by Marriage as the area affected by tidal action.

Table 3. Dimensions of Tillamook Bay [55].

distance from throat to
farthest estuary shore--6.9 miles

inlet dimensions at throat (at MSL):

width--1,485 feet

average depth--16 feet

cross-sectional area--15,700 feet

average lagoon depth below MSL--5 feet

The five major tributaries of the bay are the Miami River from the north, the Kilchis and Wilson Rivers from the east, and the Trask and Tillamook Rivers from the south. About 19 smaller tributaries also discharge directly into the bay. Table 4 presents the lengths, drainage areas, annual fresh water yields, and the approximate distance from the estuary mouth to the zero river mile of each of these five larger rivers [89,95-map].

A good deal of information on Tillamook Bay has been compiled by Thos. J. Murry and Associates in "Development Program for Tillamook Bay, Oregon." [120]. The study is referred to frequently here.

The U.S. Army Corps of Engineers constructed a physical model of Tillamook Bay in 1970 to consider problems developing in connection with the construction of the south jetty [83,115]. This is mentioned in more detail under "Physical Alterations."

Port commissions for the area have their headquarters in Tillamook and Garibaldi and can be contacted at the following addresses and phone numbers:

Tillamook Bay

Port of Tillamook Bay
P.O. Box 113
Tillamook, Oregon 97141
842-2413

Port of Bay City
P.O. Box 228
Garibaldi, Oregon 97118
322-3292
322-3279

Table 4. Lengths, drainage areas, and fresh water yields of Tillamook Bay tributaries [89,95].

| stream | distance from estuary mouth to zero river mile ¹ (miles) | length (miles) | drainage area (sq mi) | average annual fresh water yield ² (ac-ft) |
|-----------------|--|-------------------|--------------------------|--|
| Miami River | 3 | 13.6 | 36 | |
| Kilchis River | 6 | 13.8 ³ | 67 | |
| Wilson River | 6.5 | 33.2 ⁴ | 193 | 1,071,600 |
| Trask River | 7.5 | 18.2 ⁵ | 176 | 839,800 |
| Tillamook River | 7.5 | 18.4 | 61 | 292,500 |

¹Estimated from [89-map]

²Estimated for 1933 to 1958 [89]

³To the confluence of North Fork and South Fork

⁴To the confluence of Devils Lake Fork and South Fork

⁵To the confluence of North Fork and South Fork

Drainage Basin

Tillamook Bay drains an area of 540 sq mi [89-map]. The average annual fresh water yield of three of its major tributaries (Wilson, Trask, and Tillamook Rivers) totals 2,203,000 ac-ft. These three rivers drain a combined area of 430 sq mi or about 80% of the drainage basin [85].

Principal trees in the watershed are douglas fir, hemlock, and spruce [121]. Timberlands, owned primarily by large corporations, lie to the north and south of the estuary. Located to the east is an area of 300,000 acres hit by forest fires in 1933, 1939, and 1945 and known as the "Tillamook Burn" [120,121].

Precipitation ranges from an annual average of 90 inches along the coast to 150 inches in the north central portion of the watershed [89]. There are several climatological stations in the Tillamook Bay area, and precipitation records are available through the OSWRB from at least 2 of them as described in Table 13. Major floods occurred in the Tillamook Bay area in January 1972 and in 1964.

The average air temperature at the city of Tillamook is 51°F with recorded extremes of 0°F and 101°F [89]. Wind roses there show January winds with speeds of 4 to 31 mph coming from the south or from the east about 30% of the time. In July, winds are primarily from the northwest (about 35% of the time) and also have speeds generally from 4 to 31 mph [138].

Tillamook Bay

Stream profiles for the Tillamook Estuary river systems appear on page

Hydraulic Description of Estuary

Tides and Currents

Tillamook Bay is described as being well protected from waves at the throat [55]. Tidal effects extend to the following points on its five major tributaries: Kilchis River--mile 1.3, Miami River--mile 0.4, Tillamook River--mile 7.0, Trask River--mile 4.2, and Wilson River--mile 2.4 [69].

The mean tide range is 5.7 feet with a diurnal range of 7.5 feet [55] and an extreme tidal range of 13.5 feet [86]. Tidal prism on mean range is 1.635×10^9 cu ft with a diurnal range of 2.15×10^9 cu ft [55].

River Discharges

Stream gaging stations are located at mile 11.4 of the Wilson River and at mile 10.4 of the Trask River (Table 13) [140]. Flow rate extremes and means recorded at these two stations are given in Table 5.

Table 5. Flow rates of Tillamook Bay tributaries [140].

| stream | point of measurement (river mile) | drainage area (sq mi) | complete water years of record | flow rate (cfs) | | |
|--------------|--------------------------------------|--------------------------|-----------------------------------|----------------------|---------------|-------|
| | | | | maximum | minimum | mean |
| Wilson River | 11.4 | 161 | 40 | 32,100 (12/22/64) | 34 (9/67) | 1,205 |
| Trask River | 10.4 | 145 | 33 | 23,000 (12/22/64) | 42 (10/52) | 959 |

Salinity and Classification by Mixing

Salinity measurements of the Tillamook River by Burt and McAllister were made once (each month) in October 1957 and January, April, and July 1958 [12]. Maximum intrusion for these four times was on July 23, 1958 when salinity was measured at concentrations of 8.2 ppt (21.9°C) on the surface and 8.6 ppt (21.8°C) on the bottom (12 feet) at a point 13.2 miles from the ocean. Measurements beyond this were not reported.

On the basis of salinity change from top to bottom, Burt and McAllister have classified Tillamook Bay as a two-layered system during January and as a well-mixed system during April and October [13].

Tillamook Bay

Sediments

Net littoral drift in this area is to the north [57].

Since the completion of the north jetty in 1933, material has been deposited behind it, and erosion of the shore along the Bayocean Peninsula (to the south of the estuary mouth) has been a problem. In 1952 this erosion reached a point where the southern portion of the peninsula was breached. Four years later a dike (as described under "Physical Alterations") was constructed to help close this gap. A south jetty, also described later, is now being constructed, and although erosion is continuing, it is expected that accretion along the peninsula will occur as the jetty is completed [57,120,126,129].

Sediments are being deposited in the estuary at an estimated rate of 135,000 tons annually [57], and the estuary is now believed to be about 40% of its original size [53]. Erosion of the drainage basin following major fires as described earlier has contributed to this filling [53]. To help reduce the quantity of sediments being deposited at the river mouths, it has been suggested that a system of multiple-purpose channels and sediment-settling basins be developed [120].

Analyses of dredge samples taken from the bay at a point 1 mile from the mouth in August 1962 show a void ratio of 0.604 and a mean grain size that of fine sand [124].

Water Quality Information

As of May 1972 data from 12 water surveillance stations in Tillamook Bay were available through the DEQ (Table 13) [67,68]. Records have been kept at most of these stations since 1960 but do not generally include DO, BOD, conductivity, turbidity and PBI data until 1966. The DEQ also conducted two comprehensive studies in 1972 and 1973, in addition to routine surveillance, on the levels of coliform bacteria present in the oyster growing regions of Tillamook Bay.

Water temperature records are available for the Wilson River near mile 11.4 [138] and for the Trask River at mile 10.4 [141] (Table 13). Temperatures at the Wilson River station have been reported as adjusted monthly averages and have ranged from 2°C for February to 24°C for July. Records from the Trask River station show daily temperature extremes. Between 1962 and 1968, these ranged from 1°C (January 1963) to 22°C (May of 1967 and 1968). The greatest range of temperature during a single day in 1968 was 4°C (18°C to 22°C).

Sewage treatment plants in the Tillamook Bay area are presently in operation for the cities of Tillamook and Garibaldi, Tillamook Creamery Association, and the Tillamook Airport Industrial Park. Also, a treatment plant to serve Bay City is now under construction. Information about these facilities has been summarized in Table 6 [108,120].

Tillamook Bay

Table 6. Sewage treatment plants at Tillamook Bay [108,120].

| | city of Tillamook | city of Garibaldi | Tillamook Creamery Association | Tillamook Airport Industrial Park | city of Bay City |
|---------------------------------|------------------------|---|---|--|---|
| completion date | (updated in 1970) | 1958 ¹ | | | now (11/72) under construction |
| location | | boat basin area; south- west of city shops | about 1 mile north of Tillamook city | | |
| area served | | | handles industrial waste and sewage at the cheese manufacturing plant | | |
| number now serving | 4,000 | 1,250 | | 614 | 960 |
| number capable of serving | 7,000 | | | 1,060 | 2,120 |
| description | secondary treatment | | secondary treatment; activated sludge and aerated basin | secondary treatment | 14-acre- lagoon treatment facility |
| average flow (mgd) | | | | | |
| rainy | 0.4 to 0.6 | | | | |
| dry | 0.125 (10/20/72) | | | | |

¹Being replaced by an activated sludge sand filtration plant with secondary treatment; to be capable of serving 2,500.

Table 7. Estimated numbers of adult anadromous salmonids spawning in the major tributaries of Tillamook Bay [77].

| stream | chinook | | coho | chum | steelhead | | sea-run cutthroat |
|-----------------|---------|--------|--------|-------|-----------|--------|----------------------|
| | spring | fall | | | winter | summer | |
| Miami River | 90 | 540 | 270 | 2,850 | 675 | 50 | 2,500 |
| Kilchis River | 540 | 2,970 | 1,890 | 4,050 | 4,000 | 100 | 3,000 |
| Wilson River | 1,800 | 9,900 | 6,300 | 1,500 | 33,600 | 2,000 | 5,000 |
| Trask River | 3,150 | 17,325 | 23,275 | 1,000 | 11,000 | 200 | 5,000 |
| Tillamook River | 540 | 2,970 | 1,890 | 500 | 300 | 50 | 2,500 |
| totals | 6,120 | 33,705 | 33,625 | 9,900 | 49,575 | 2,400 | 18,000 |

Tillamook Bay

Biological Information

Estimated numbers of chinook, coho, chum, steelhead, and sea-run cutthroat spawning in the five major tributaries of Tillamook Bay are shown in Table 7 [77]. In comparison with other estuarine rivers and river systems (Table B), these numbers are quite high.

Salmon and perch provide excellent sport fishing there, and clam digging and crabbing are important both recreationally and commercially, as discussed later [38,86,126]. Clams found in the estuary include gaper and cockle in the northern section, softshells near the southern portion, and some butter, littleneck, and razor clams near the mouth [38,53,155]. The bay is also the main oyster producer in the state, but the oysters must be seeded in order to grow [89,120,155].

The estuary is used by widgeon, pintail, canvas back, scaup, and other ducks during fall and winter, and it is the main black brant wintering area of Oregon [89,155].

A much more complete listing of fish, waterfowl, shore birds, and wildlife found in the area, provided by the Bureau of Sports Fisheries and Wildlife, the OSGC, and the FCO, is presented in the T.J. Murray report [120], where it is also stated that, according to OSGC and FCO representatives, there are no endangered species (as defined by Congress in the Endangered Species Act of 1966 and in the Endangered Species Conservation Act of 1969) in the Tillamook Bay area.

Physical Alterations

Proposed alterations to the estuary by the U.S. Army Corps of Engineers include two jetties, a channel through the ocean bar to Miami Cove and then on to Hobsonville, turning basins at Miami Cove and Hobsonville, a small boat basin at Garibaldi, and a dike to close the breach in the Bayocean Peninsula [55,120,126,129]. The north jetty, channel system to Miami Cove, small-boat basin, and dike have all been completed. The south jetty has been partially constructed as has the turning basin at Miami Cove (most of which is described as being inactive) [126]. The channel from Miami Cove to Hobsonville and the turning basin, also described as inactive [126], have apparently not yet been constructed. Dimensions and construction dates are given in Table 8.

U.S. Army Corps of Engineers dredging records from 1959 through 1969 (excluding 1968) show that (1) the entrance bar and inner channel were dredged annually from 1962 through 1966 with an average of 57,232 cu yds being removed; (2) the small boat basin and approach channel were dredged in 1959 with a total of 11,724 cu yds removed; and (3) there was no dredging in 1960, 1961, 1967, and 1969 [55]. The Corps of Engineers was to issue an invitation for bids for dredging about 200,00 cu yds from the lower 5,000 feet of the Trask River and the lower 8,000 feet of the Wilson River with the bid opening on July 31, 1972 and the dredging to be completed 60 days after the bid [120].

Tillamook Bay

Table 8. U.S. Army Corps of Engineers Modifications to Tillamook Bay
[55,120,126,128,129].

| Proposed Modification | Location | Dimensions | | | (1) Date and Status |
|-----------------------|---|-------------------|------------------|------------------------------|---|
| | | depth (feet) | width (feet) | length | |
| North Jetty | Entrance | | | 5,700 feet | 1933-completed 1965-rehabilitated |
| South Jetty | Entrance | | | 8,000 feet ⁽²⁾ | 1965-authorized 1969-construction started 1971-completed to 4,200 feet 1974-scheduled for completion |
| Channel | Entrance | 18 ⁽³⁾ | Not Specified | | 1927-completed |
| Channel | Entrance to Miami Cove | 18 ⁽³⁾ | 200 | 3 miles | 1927-completed |
| Turning Basin | Miami Cove | | | | 1968 (publication date)- "most of it inactive" |
| Small-boat Basin | Garibaldi | 12 | | | 1958-completed |
| Channel | Miami Cove To Hobson- ville | 16 ⁽³⁾ | 200 | 4,000 feet | 1968 (publication date)- "Inactive" |
| Turning Basin | Hobsonville | | | | 1968 (publication date)- "Inactive" |
| Dike | Bayocean Peninsula- Between Pitcher Point and Bayocean | | | 1.4 miles | 1956-completed |

¹Lack of completion date does not necessarily signify that the modification has not been constructed.

²Modified to 6,500 feet after scouring at the completed end during the winter of 1971-72.

³The possibility of deepening the entrance channel to 40 feet and the inner channel to 30 feet is being considered.

Tillamook Bay

Navigable lengths of the Tillamook Bay tributaries are as follows: Kilchis River--2 miles, Miami River--0.5 miles, Tillamook River--16.0 miles, Trask River--2.0 miles, and Wilson River--3.0 miles.

Between 1960 and 1969, traffic using the channel system averaged 99,000 tons annually, and until 1967, rafted logs accounted for from 20,000 to 70,000 tons each year. In 1969 traffic reached 250,000 tons and consisted entirely of inbound crushed rock for use in jetty construction [120,129].

Future modifications to the bay as well as plans for continuing (or altering) present projects are being considered. A U.S. Army Corps of Engineers study of the navigation features of Tillamook Bay has been authorized and is ready (July 1972--publication date) for implementation pending decision by the local port authorities as to improvements to be proposed [120]. Examples of projects which are being discussed and questioned include completion of the south jetty, deepening of channels, and a method of reducing sedimentation in the bay.

Concerning the south jetty, there has been some problem, due to the scouring off its completed end, as to the way work on it should proceed. At one time, the possibility of leaving temporary gaps in the jetty to minimize scour and then filling the gaps as a final stage was to be tested through the U.S. Army Corps of Engineers physical model of Tillamook Bay [155]. As of July 1972, however, plans were reportedly to complete the jetty to a final length of 6,500 feet by 1974, and no mention of leaving gaps was made [120].

Also under consideration is a proposal to deepen the entrance channel to 40 feet and the inner channel to 30 feet [55,120,129]. This is discussed in the T.J. Murray report [120]. To help alleviate the problem of sedimentation at the mouths of the tributaries to the bay, it has also been suggested in that report that a system of multiple purpose channels and sediment settling basins be developed.

The Division of State Lands inventory of filled lands in Tillamook Bay has been completed and is now available [69]. Some of the information from it is given in Table C.

The FCO operates the Trask River Salmon Hatchery located near the junction of Gold Creek and the Trask River at a point 5 miles east of the city of Tillamook and near mile 7 of the Trask River [54]. Total releases, all coho and spring chinook, from the hatchery to Oregon waters (the Trask River, coastal tributaries, and Gold Creek) between July 1, 1968 and June 3, 1969 numbered 1,206,463 [33]. A fishway, located on Fall Creek and called the Fall Creek Fishway, was completed in 1964 under the FCO "Coastal 60-40 Program" [119]. The creek is a tributary of the Wilson River at mile 17.2.

Tillamook Bay

Estuary Uses

Industrial and Commercial

Major industries around the bay are those connected with timber, agricultural products, fish and seafoods, and tourism [20,34,89,118,121,155].

A listing of the manufacturers in the area is given in Table 9 [71].

Table 9. Major Manufacturers at Tillamook Bay [71].

| Location | Name | Type of Business | Number Employed |
|-----------|--|--|-----------------|
| Garibaldi | Oregon-Washington Plywood Co. | sanded plywood | 280 |
| | Edmunds Fish and Crab Co. | seafoods (canning) | 21 |
| | Smith Pacific Shrimp Co. | shrimp (packaging) | 24 |
| | 7 manufacturers employing less than 20 | dealing in lumber and wood products and food (fish, seafoods, and meat). | |
| Bay City | McRae and Sons Inc. | furniture; brush parts | 20 |
| | 2 manufacturers employing less than 10 | dealing in packaged fish and seafoods | |
| Tillamook | Tillamook Veneer Co. | plywood | 275 |
| | Publishers Paper Co. | lumber | 200 |
| | Diamond Lumber Co. | lumber | 175 |
| | Tillamook County Creamery Association | cheese, butter, milk and whey, feeds | 150 |
| | Crown Zellerbach Corp. | logging | 140 |
| | 21 other manufacturers employing 20 or under | dealing in a variety of products, the main ones being lumber and wood products | |

Tillamook County is a center of lumber production with its greatest income being derived from forest products [121]. About half of its basic industry jobs are provided by independently owned lumber and plywood mills in the Tillamook Bay area [120]. Long-term stabilization of the wood processing industry will reportedly depend on the operations of the major timberland owners in Tillamook County and on developing both more modern facilities and the capability of utilizing smaller trees [120].

Tillamook Bay

The four major wood processing plants in the vicinity of the bay, listed in Table 9, are the Oregon-Washington Plywood Co. (on tidewater at Garibaldi), Publishers Paper Co., Tillamook Division (in the city of Tillamook), Diamond Lumber Co. (southeast of the city of Tillamook in the Tillamook Airport Industrial Park), and the Tillamook Veneer Co. (also in the Tillamook Airport Industrial Park) [71,120]. Crown Zellerbach Corp. and Publishers Paper Co. are the major private timberland owners in the county [120], and the Forest Service and BLM manage extensive acres with the State Forestry Department managing the Tillamook Burn (described earlier) [121].

Commercial fishing activities are centered at the small boat basin at Garibaldi where the commercial fleet is moored with 119 commercial fishing boats having annual moorage and over 200 more delivering to the processing plants, which are also concentrated in that area as indicated in Table 9 [71,120]. With the exception of oysters, commercial harvests directly from the estuary (Table 10) are quite limited; however, landings from the entire area (Table 11) with a total value to fishermen of over \$900,000 during 1971 provide some income [34,77,118]. A comparison with landings received at other estuaries can be made from Tables D and E.

Table 10. Commercial Harvest of Clams, Crabs, and Oysters From Tillamook Bay [77,118].

| Species | 1969 pounds landed | 1970 | | 1971 | |
|---------|--------------------------|------------------|--------------------|------------------|--------------------|
| | | pounds landed | fishermen value | pounds landed | fishermen value |
| Clams | 4,770 | 7,819 | \$ 1,000 | 5,948 | \$1,000 |
| Crabs | | 47,160 | | 92,465 | |
| Oysters | | 241,929 | \$236,000 | | |

Table 11. Commercial Harvest Food Fish Received at Tillamook, 1971(1) [34].

| Species | Harvest (pounds round weight) | Fishermen value |
|------------------|-------------------------------------|--------------------|
| Crabs | 987,058 | \$227,000 |
| Shrimp | 896,080 | 109,000 |
| Coho | 777,671 | 243,000 |
| Oysters | 239,136 | 270,000 |
| Albacore Tuna | 118,217 | 37,000 |
| Groundfish | 72,689 | 6,000 |
| Chinook | 18,449 | 10,000 |
| Clams | 5,948 | 1,000 |
| Pinks | 5 | |
| Miscellaneous(2) | 688 | 1,000 |
| Totals | 3,115,941 | \$904,000 |

1Includes 1971 data presented in Table 10.

2Sand shrimp, crawfish, eel. 217

Tillamook Bay

Oysters, which must be seeded for growth to occur, are cultivated in 2,650 acres of Tillamook Bay leased from the FCO. About 85% of the oysters grown in Oregon are seeded and produced there by Hayes Oyster Co., Tillamook Oyster Co., and Olsen Oyster Co. [69,89,120,155].

There are 565 dairy farms in Tillamook County, and the Tillamook County Creamery Association, listed in Table 9, is well known for its dairy products, particularly its cheddar cheese. Located just north of Tillamook on Highway 101, it is reportedly the west's largest cheese plant [89,106,121].

Recreational

Fishing, clamming, and crabbing are some of the major aspects of tourism in the area [121]. Species most commonly caught (excluding salmon and trout), as determined in the FCO study between March and October 1971, include pile perch, kelp greenling, and shiner perch by shore angling; dungeness crab by boat angling; cockle and littleneck clams and relatively few butter clams by clamming; and some black rockfish by scuba diving [38]. Estimates of the recreational harvest of clams and non-game fish are shown in Table 12.

Table 12. Estimated Annual Harvest Data for Sport Fishing at Tillamook Bay [77].

| Species | annual harvest (total number) | effort (angler- or digger-days) | Year |
|----------------------|----------------------------------|---------------------------------------|--------------------------------|
| Non-game bay fish | 24,500 | 6,000 | 1970 |
| Clams | 540,000 | 18,000 | average of data before 1970 |

Mid April to mid May is the best time for spring chinook fishing. July and August are good for offshore salmon trolling and September through December provides good coho fishing. Mid September to mid October marks the peak fall chinook fishing. The Wilson and Trask Rivers are the most heavily fished areas, although the Tillamook, Miami, and Kilchis Rivers are also popular [58].

Boat landings on the estuary include the Garibaldi ramp at Garibaldi, the Tillamook Bay County boat launch at the south end of the bay, the Siskeyville Boat Slide on the Wilson River near mile 12, and the Tillamook Marine Park on Hoquarten Slough near Tillamook [91,121]. Various aspects of recreational boating, including (1) an Oregon State Marine Board Survey of Oregon boating facilities (1971), (2) suggestions for further development for boat use; and (3) the 1971 number of small boat round-trip crossings of Tillamook Bay, have been presented in the T.J. Murray reference [120].

Tillamook Bay

The Wilson River Highway Forest Wayside on the Wilson River near mile 20 and the Trask Guard Station (State Forestry) on the Trask River at approximate river mile 18.5 are State Parks in the area. County Parks include Barview Wayside on the north side of the estuary at the mouth, Wilson River Wayside on the Wilson River at various points between miles 10 and 18, Kilchis on the Kilchis River at approximate river mile 7, and Peninsula Park on the Trask River near mile 13.5 [91,121].

Table 13. Surveillance stations at Tillamook Bay.

| type of station | name and/or identifying number | approximate location | drainage area (sq mi) | period of record | references |
|------------------------|--|---|-----------------------|----------------------------------|-----------------------------|
| climatological | Bay City | Tillamook Bay; north side; elevation--14 feet | | 1896-1912 | [89,90] |
| | Tillamook | Trask River; mile 2.5; elevation--33 feet | | 1886*(1960) | [89,90] |
| | Tillamook Naval Air Station | Trask River; mile 5.5; elevation--45 feet | | 1945-1948 | [89,90] |
| | Tillamook 12 E; Tillamook 11 E; Trask; USGS #8504 | Trask River; mile 18.5; elevation--320 feet | | 1909-1912 1940-(1960) | [89,90,92,143] |
| | Tillamook 1 W; USGS #8494 | elevation--10 feet | | 1889* | [92,143] ¹ |
| stream gaging | Trask River near Tillamook; USGS #3025 | Trask River; mile 10.4 | 145 | 7/31*(1970) | [89,90,98,140] |
| | Wilson River near Tillamook; USGS #3015 | Wilson River; mile 11.4 | 161 | 10/14*(1970) | [89,90,98,140] ² |
| | North Fork Wilson River near Tillamook; USGS #3020 | Wilson River; mile 8.5 | 19.9 | 1913-1917 | [89,90] |
| DEQ water surveillance | #1 | temp. channel marker 45 yards N, 15 yards E BW "A" | | 2/60-(4/72) (92 measurements) | [67,68] ³ |
| | #2 | temp. channel marker 50 yards N, 15 yds E BW "B" | | " | " |
| | #3 | pile--near covered jetty 70 yards S, 10 yards E | | 2/60-(4/72) (91 measurements) | " |
| | #4 | Dick Pt. Dike near North End 145 yards S, 100 yards E | | " | " |
| | #5 | Memaloose Pt. 100 yards N, 0 yards E/W | | 2/60-(4/72) (92 measurements) | " |
| | #6 | Pitcher Pt. 1/2 mile E, 1/4 mile N | | 2/60-5/72 (100 measurements) | " |

Tillamook Bay

Table 13. Surveillance stations at Tillamook Bay, cont.

| type of station | name and/or identifying number | approximate location | drainage area (sq mi) | period of record | references |
|------------------------|--------------------------------|---|-----------------------|-----------------------------------|----------------------|
| DEQ water surveillance | #7 | opposite Sandstone Pt. 225 yards S, 1.59 miles W | | 2/60-(5/72) (102 measurements) | [67,68] ³ |
| | #8 | flashing green light #17, 0.91 mile S 500 yards W | | 2/60-(5/72) (127 measurements) | " |
| | #9 | flashing light #19, 30 yards S, 100 yards W | | 2/60-(4/72) (98 measurements) | " |
| | #10 | Hobsonville Point, 700 yards S, 340 yards E | | " | " |
| | #11 | Sandstone Point, 100 yards N, 0.55 mile W | | 6/62-(5/72) (34 measurements) | " |
| | #12 | Dick Point Dike South End, 30 yards S, 50 yards E | | 2/72-(4/72) (11 measurements) | " |
| water quality | Wilson River (mile 6.5) | | | | [89,90] |
| water temperature | Trask River near Tillamook | Trask River; mile 10.4 | 145 | 4/62-(9/68) | [141] |
| | Wilson River near Tillamook | Wilson River; mile 11.4 | 161 | 1/47-(9/62) | [138] |
| | Wilson River (mile 6.8) | | | 8/60 | [89,90] |

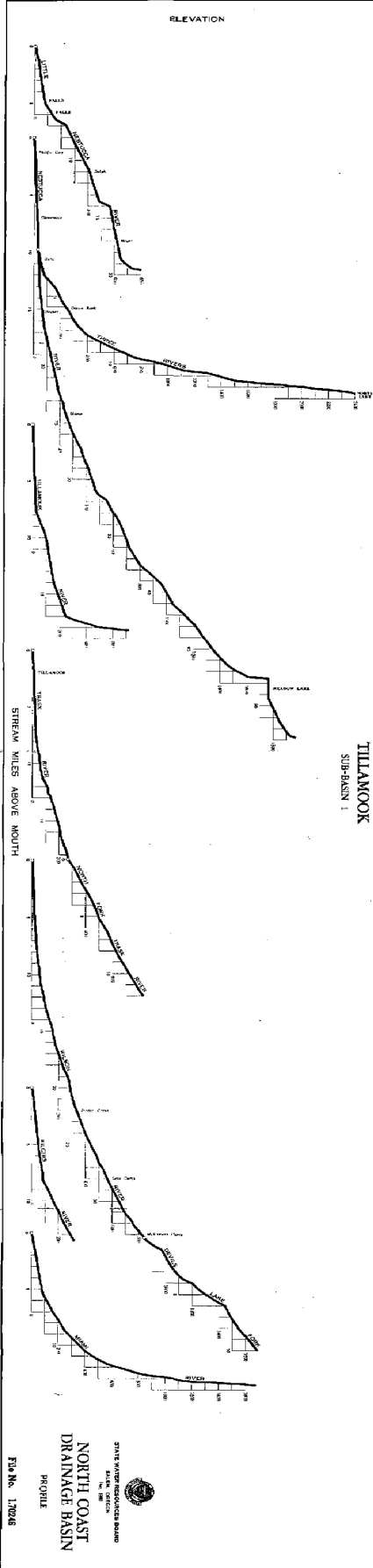
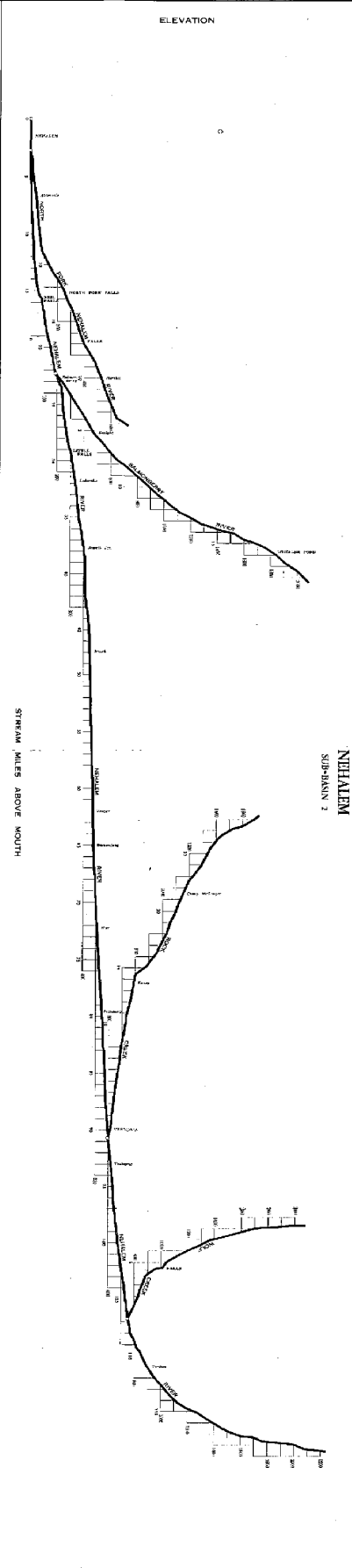
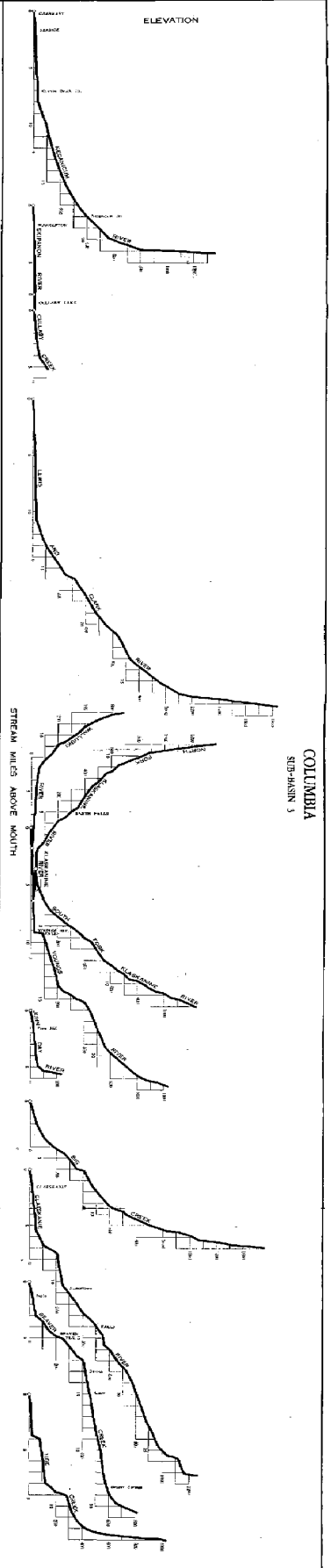
¹ Precipitation data available in punch card or printout form through the OSWRB.

² Monthly and water-year runoff records have been compiled and are available in punch card or printout form through the OSWRB.

³ Data available in punch card or printout form through the DEQ; records are not complete before 1966.

() This is the most recent record date found and is not necessarily the last.

* Period of record is not continuous.



STATE WATER RESOURCES BOARD
NORTH COAST
DRAINAGE BASIN
PROFILE
FIG. NO. 17246

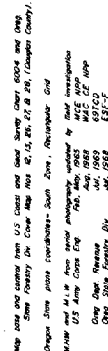
UMPQUA BAY

Mean High Water

Mean Low Water

Oregon Shores Vegetation Line

Section corner



UMPQUA BAY

General Description of Estuary and Drainage Basin

Estuary

Located about 180 miles south of the Columbia River mouth, Umpqua Bay ranks third in size of the estuaries included here (Table A). Its largest and only incorporated town is Reedsport. Table 1 lists the locations and 1970 census figures of this and other population centers in the area.

Table 1. Population centers at Umpqua Bay¹ [97,111].

| name | general location | river mile location | approximate distance from estuary mouth (miles) | 1970 population |
|------------------------|--------------------------|---------------------|---|----------------------|
| Winchester Bay | Umpqua River; south side | 1.7 | 1.7 | 500 |
| Gardiner | Umpqua River; north side | 9.0 | 9.0 | 500 |
| Reedsport ² | Umpqua River; south side | 10.7 to 12.6 | 10.7 to 12.6 | 4,039 |
| Murphys Camp | Umpqua River | 26.3 | 26.3 | no winter population |
| Scottsburg | Umpqua River; north side | 27.5 | 27.5 | 200 |
| Greenacres | Umpqua River | 30.1 | 30.1 | rural |
| East Gardiner | Smith River | 1.3 | 12.8 | 30 |
| Frantz | Smith River | 2.7 | 14.2 | no pop |

¹Tidal effects extend approximately to mile 28 of the Umpqua River.

²Incorporated

Approximate surface area of the estuary is 6,430 acres of which between 20% and 30% is tidelands, as shown in Table 2. These tidelands are found mainly between the mouth and mile 14 (about 1 mile above Reedsport). Other estuary dimensions are given in Tables 3 and 4.

Table 2. Reported surface areas of Umpqua Bay [55,59,71].

| reference | surface area (acres) | measured at | tidelands | | submerged lands | |
|-----------|----------------------|--------------|-----------|---------|-----------------|---------|
| | | | acres | percent | acres | percent |
| [55] | 6,749 | HW | | | | |
| | 5,303 | MSL | | | | |
| | 3,845 | LW | | | | |
| [59] | 5,712 | ¹ | 1,548 | 27 | | |
| [71] | 6,830 | MHT | 1,531 | 22 | 5,298 | 78 |
| | 5,298 | MLT | | | | |

¹Specified by Marriage as the area affected by tidal action.

Umpqua Bay

Table 3. Dimensions of Umpqua Bay [55].

distance from throat to
farthest estuary shore--13.5 miles

inlet dimensions at throat (at MSL):
width--1,980 feet
average depth--20 feet
cross-sectional area--33,000 sq ft

average lagoon depth below MSL--15 feet

Table 4. Cross-sectional areas of Umpqua Bay, 1962 [40].

| Point of measurement (river mile) | Cross-sectional area (sq ft) ¹ |
|--------------------------------------|--|
| 0 | 22,000 |
| 3 | 30,500 |
| 7 | 14,925 |
| 8 | 28,800 |
| 11 | 5,840 |

¹ Taken perpendicular to the main channel
for water level at 0 feet above MLLW.

Umpqua Bay, in effect, consists of the lower reaches of the Umpqua River with the estuary mouth and zero river mile being the same point. The major tributary to mile 28 (head of tidewater) is the Smith River at mile 11.5. Mill Creek, at mile 24.2, is the next largest tributary within tidal effects, and there are numerous smaller creeks. Lengths and drainage areas of these three larger streams (the Umpqua and Smith Rivers and Mill Creek) are presented in Table 5.

Table 5. Lengths and drainage areas of Umpqua Bay tributaries [97,99].

| stream | length (miles) | drainage area (sq mi) |
|--------------|--------------------|--------------------------|
| Umpqua River | 111.7 ¹ | 4,560 |
| Smith River | 89.6 | 347 |
| Mill Creek | 22 | 135 |

¹ To the confluence of the North Umpqua River and the South Umpqua River

Umpqua Bay

At least two physical models have been made of Umpqua Bay--one through Washington State University [40] and the other by the U.S. Army Corps of Engineers [32]. The Washington State University model, completed some time before August 1962 (publication date), was used

- (1) to determine whether a highly distorted small scale model could be made to operate satisfactorily;
- and (2) to determine the pollution potential of the Umpqua Estuary under certain outfall conditions [40].

The Corps of Engineers model was used in a testing program in 1967 and 1968 at the Hydraulics division of the U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi. The purpose of the program was to

determine the optimum plan for the reduction of shoaling and elimination of cross-currents in the navigation channel at the entrance [32].

These studies have been described in detail in the references cited.

The port commission and industrial development corporation for the area are located in Reedsport and Roseburg with addresses and phone numbers as follows:

Port of Umpqua
Reedsport, Oregon 97467
271-3636

Umpqua Development Corp.
410 S.E. Spruce St.
P.O. Box 1026
Roseburg, Oregon 97470
672-2648

Drainage Basin

The Umpqua River drainage basin covers 4,560 sq mi and yields 6,700,000 ac-ft of fresh water annually with extremes of 12,000,000 ac-ft and 2,750,000 ac-ft [99]. Precipitation records are available from several climatological stations in the basin (Table 13). The average annual rainfall ranges from 25 to 110 inches with 50 to 110 in the Coastal Range, 25 to 50 inches in the "Central Valley" (the area of the confluence of the North and South Umpqua Rivers), and 50 to 75 inches in the Cascade Mountains [99]. Average rainfall along the coast (western Douglas County) is 77 inches, and the average air temperature there is 52°F [58].

Elevations are from sea level to 3,000 feet in the Coast Range and 9,000 feet in the Cascade Range [99].

Hydraulic Description of Estuary

Tides and Currents

The estuary is described as being fully exposed to waves at the throat [55]. Tidal effects extend up the Umpqua River as far as Scottsburg at river mile 27.5 [99,126]. The mean tide range is 5.1 feet, the diurnal range 6.9 feet [55], and the extreme range 11.0 feet [86]. Tidal prism on mean range is 1.18×10^9 cu ft with a diurnal range of 1.595×10^9 cu ft [55].

River Discharges

Records kept between 1905 and 1970 at a stream gaging station (Table 13) located on the Umpqua River at mile 56.8 where the drainage area is 3,683 sq mi (80% of the total basin) show an average discharge of 7,435 cfs and extremes of 265,000 cfs (December 23, 1964) and 640 cfs (July 18, 1926) [140]. The average maximum and minimum daily flows at this same spot, but for the 14-year period between 1953 and 1967, were 125,000 cfs and 900 cfs [7].

There are numerous stream gaging stations in the Umpqua River system, but the only other major tributary for which records will be given here is the Smith River, which has a station located at mile 28.5 where the drainage area is 206 sq mi (Table 13). The station has been in operation since October 1965 and recorded an average discharge between then and 1970 of 685 cfs with extremes of 26,700 cfs (January 3, 1966) and 4.3 cfs (August 26, 1966) [140].

Salinity and Classification by Mixing

In the study by Burt and McAllister, salinity measurements were taken in the Umpqua River in June 1956, October 1957, and January, March, and July 1958 [12]. Of these five times, maximum intrusion was found on October 6, 1957 at HHW when it reached a point 16.7 miles from the ocean at concentrations of 1.3 ppt on the surface and 1.5 ppt on the bottom (5 feet) with a concurrent temperature of 15.8°C at both points. Measurements beyond this were not reported.

More extensive salinity data were taken by R.J. Callaway through the Department of Health, Education, and Welfare, Public Health Service, in 1961 [15,16,17].

Also, the U.S. Army Corps of Engineers measured surface and bottom salinity at miles 1 and 2 of the estuary in verifying its physical model of Umpqua Bay [32]. The measurements were taken during 1966 on March 30-31 and August 3-4. The greatest range in concentration on the surface was found during the March 30-31 period at mile 1 where it ranged from 3 ppt to 26.5 ppt. Fresh-water discharge at that time was 17,000 cfs. The greatest range on the bottom also occurred during March 30-31, but at mile 2, and was from 5 ppt to 30 ppt.

Salinity, velocity and dissolved oxygen data were taken by Callaway [15,16,17], who also observed the intrusion of low dissolved oxygen (<2 ppm) due to upwelling.

The estuary as classified by Burt and McAllister on the basis of mixing was found to be a two-layered system in January and February; a partly-mixed system in March, May, and October; and a well-mixed system in July [13].

Sediments

Net transport of material along the coast near Umpqua Bay seems to be to the south, and there is some erosion south of the south jetty [57]. Movement of sand sediments around the north jetty and into the estuary during high tide has been observed through aerial photographs [53]. Sediments transported to the estuary from its drainage basin are estimated at 564,000 tons annually [85].

Analyses of U.S. Army Corps of Engineers dredge samples taken at numerous points within the estuary from November 1970 to August 1971 show the following: (1) organic contents ranging from 0.91% to 3.27% (both samples were taken in August 1971--the first from the east side between miles 5.30 and 5.50 and the second from the west side at Buoy #9); (2) void ratios ranging from 0.772 (November 1970 at milepost 80-100 at Barretts upper dike) to 0.967 (August 1971 from the west side at Buoy #9); and (3) mean grain size that of fine sand [124].

Water Quality Information

The DEQ operates seven water surveillance stations in the estuary for which records are available in punch card and printout form for about 25 sampling dates since 1957 [67,68]. Locations of these stations are given in Table 13.

Sewage treatment facilities in the area consist of a new plant in Reedsport and a new sanitary district in Gardiner which pumps into the Reedsport plant. Plans are underway for construction of a plant in Winchester Bay. The plant in Reedsport is a secondary treatment facility, located on the south side of the Umpqua River between the Highway 101 bridge (mile 11.0) and the Southern Pacific Railroad bridge (mile 11.3). Operating since September 1970, it serves the cities of Reedsport and Gardiner. Daily flow averaged 725,000 gallons in September 1972 and 707,000 gallons in October 1972 (both fairly dry months); during rainy weather, it peaks at 2,000,000 gallons [63,97,110].

A water quality problem has arisen from logging operations as well as from sand and gravel and agricultural practices in the area. These activities all cause an increase in silt resulting in turbidity and (when high enough in concentration) destruction of eggs in the spawning grounds [155].

Biological Information

Estimated numbers of adult anadromous salmonids spawning in the Umpqua and Smith Rivers and in the entire Umpqua River system are shown in Table 6. In comparison with the other estuarine river systems included in this

Table 6. Estimated numbers of adult anadromous salmonids spawning in the Umpqua River system [79].

| stream | chinook | | coho | steelhead | | sea-run cutthroat |
|------------------------|---------|-------|--------|-----------|--------|----------------------|
| | spring | fall | | winter | summer | |
| Umpqua River | 0 | 2,200 | 15,000 | 10,500 | 0 | 8,000 |
| Smith River | 0 | 1,000 | 5,000 | 10,000 | 0 | 10,000 |
| Umpqua River system | 12,600 | 5,000 | 25,000 | 40,000 | 12,000 | 30,000 |

report (Table B), the Umpqua has relatively high numbers of spring chinook, steelhead (winter and summer), and sea-run cutthroat [79].

Salmon and trout provide good fishing, as do tomcod, perch, striped bass, and green and white sturgeon (in the upper bay). Dungeness crab and soft shell clams are also commonly taken. The clams are found mainly in the tidal flats near the northern bend of the estuary around mile 6.5 where near optimum conditions for them exist. Gaper clams are frequently taken in Winchester Bay [38,79,155].

Scaup are found in the upper bay, and other ducks use the estuary in the fall during migration. Band-tailed pigeons exist on the tidal flats [79,155].

The entire area around the estuary is considered a winter range for big game, which, in order of abundance, include black-tailed deer, Roosevelt elk, white-tailed deer, black bear, and cougar [79].

Physical Alterations

Completed and proposed alterations to the estuary by the U.S. Army Corps of Engineers consist of three jetties, a main channel to Reedsport with a turning basin there, side channels (with turning basins) to Winchester Bay and Gardiner; a channel in Scholfield Creek and one with a passing basin in the Smith River. These have been summarized in Table 7. As of 1971 (publication date), consideration of the possibility of expanding entrance and river channel dimensions was in the primary phase, meaning a public meeting was to be scheduled [129].

Umpqua Bay

Table 7. U.S. Army Corps of Engineers Modifications to Umpqua Bay
[55,126,129,130--#6004,128].

| | Proposed Modification | Location | Dimensions | | | Date and Status ⁽¹⁾ |
|----------------------|------------------------------|---|-----------------|-----------------|------------|--|
| | | | depth (feet) | width (feet) | length | |
| UMPQUA RIVER PROJECT | North Jetty | Entrance | | | 8,000 feet | 1940-completed |
| | South Jetty | Entrance | | | 4,200 feet | 1938-extension completed 1963-rehabilitated |
| | Training Jetty | South Side of Entrance; Mostly in- side | | | 5,500 feet | 1951-completed |
| | Channel | Entrance | 26 | | 26 feet | completed |
| | Channel | Umpqua River from the Entrance to Reedsport | 22 | 200 | 11 miles | 1941-completed |
| | Turning Basin | Reedsport | 22 | 600 | 1,000 feet | appears completed ⁽²⁾ |
| | Side Channel | From Main Channel to Docks at Winchester Bay | 12 | 100 | | appears completed ⁽²⁾ |
| | Mooring and Turning Basin | Winchester Bay | 12 | 175 | 300 | appears completed ⁽²⁾ |
| | Side Channel | From Main Channel to Gardiner | 22 | 200 | | appears at least partially completed ⁽²⁾ |
| | Turning Basin | Gardiner | 22 | 500 | 800 | |
| | Channel | Scholfield Creek-- from its confluence with the Umpqua River | 12 | 100 | 2 miles | 1971 (publication date)- "Inactive" |
| | Channel | Smith River Mouth to North Fork | 6 | 100 | 16 miles | 1957-completed |
| SMITH RIVER PROJECT | Passing Basin | Near North Fork (mile 16) | | | | 1957-completed |
| | Channel | Smith River From North Fork to Sulphur Springs | 4 | 75 | 5 miles | 1957-completed |

¹ Lack of completion date does not necessarily mean that the modification has not been constructed.

² Observed on USCGS chart #6004 (August 15, 1970).

The channel systems have been maintained by the U.S. Army Corps of Engineers and by private contractors. Corps of Engineers records of dredging activities in the entrance channel from 1959 to 1969 (excluding 1968) show the 270,151 cu yds removed in 1964 to be a fairly typical amount [50,55]. Private contractors have performed hydraulic dredging in the Smith River near Otter Slough (mile 4.4) and have spoiled either on high land behind water-tight berm or on the beach as nourishment [50].

Navigation is possible to mile 30.0 of the Umpqua River, mile 20.0 of the Smith River, mile 1.0 of the North Fork Umpqua River, and mile 6.0 of Scholfield Creek [69].

Traffic through the Umpqua River project in 1969 weighed 505,000 tons and consisted of about 50% rafted logs; "less than 50%" sand, gravel, and crushed rock; and 13% fuel oil and lumber shipments. Between 1960 and 1969 traffic averaged 810,000 tons annually. On the Smith River project rafted logs constituted about 90% of the traffic during 1969 with sand, gravel, and crushed rock accounting for the remaining 10%. Total traffic using the Smith River project during the year (1969) was 302,000 tons, which was considerably lower than the annual average (from 1960 to 1969) of 457,000 tons [129].

"An Inventory of Filled Lands in Umpqua River Estuary, June 1972" has been prepared by the Division of State Lands [69]. According to the report, there are 106.04 acres of landfills on submerged and submersible lands of the estuary. Of that total, 78.73 acres have been used to construct the marina and harbor in Winchester Bay, and most of the remaining acres are all marine oriented. Some information from that report is given in Table C, but more details (e.g., location and ownership of filled lands) can be obtained from the report itself.

A rearing pond (Camp Creek rearing pond) was constructed 21 miles east of Reedsport in 1963 under the FCO "Coastal 60-40 Program" [119].

The OSGC operates the Rock Creek hatchery on the North Umpqua River near the town of Idleyld Park which is almost 148 miles from the estuary mouth [56]. Releases from the hatchery totaled 956,598 during 1970 and consisted of 726,994 rainbow-trout, 182,914 spring chinook, and 46,690 summer steelhead [80].

Estuary Uses

Industrial and Commercial

The economy of the estuary area depends mainly on timber and fish resources, although tourism is also important, as are sand and gravel operations and dairying to some extent. In the Smith and Umpqua River valleys there is some farming and ranching based on cattle and sheep raising [58,99,110].

As can be seen from the listing of the area's manufacturers given in Table 8, paper, plywood, and lumber mills there are numerous [58,71]. Not listed in Table 8 is the Bohemia Lumber Co. operation now (October 1972)

umpqua Bay

Table 8. Major Manufacturers at Umpqua Bay [71].

| Location | Name | Type of Business | Number Employed |
|----------------|---|--|-----------------|
| Winchester Bay | Winchester Bay Seafood Co. | seafood and minkfood | 300 |
| | Salmon Harbor Seafood Inc. | canning seafood | 5 |
| | Sportsmens Cannery | salmon processing | 5 |
| Gardiner | International Paper Co. | plywood and lumber/chips | 650 |
| | Gardiner Paper Mill | paper products | 250 |
| Reedsport | Whitcomb Logging Co. | contract logger | 75 |
| | U.S. Plywood | fir veneer | 50 |
| | Reedsport Mill Co. | lumber | 50 |
| | G and C Logging Co. | logging | 28 |
| | 12 manufacturers employing less than 10 | half deal in lumber and wood products and the remaining 6 in cheese and butter; newspaper and commercial printing; perfume; concrete building blocks; machine shop and welding; pick-up tops and campers | |

under construction between Reedsport and Gardiner [110]. Statistics of waterborne traffic through the Umpqua and Smith River projects, presented in more detail under "Physical Alterations," give an indication of the extent of timber-related activities in the area. For example, in 1969 rafted logs accounted for 50% of the 505,000 tons using the Umpqua River Project and 90% of the 302,000 tons using the Smith River project [129].

Commercial fishing in the area is based at Winchester Bay where the major industry is the Winchester Bay Seafood Co., which processes a variety of fish, crab, and shrimp [58,155]. Commercial harvest from the estuary and its tributaries consists mainly of shad and striped bass and some crabs and clams. Statistics are presented in Table 9 [20,118]. Commercial landings from the entire area, shown in Table 10, are high in comparison with landings received at other estuarine ports as shown in Tables D and E.

The Umpqua River Navigation Co. maintains an extensive sand and gravel operation with headquarters in Reedsport [58]. Its floating gravel plant is used to dredge, crush, and process river run gravel. The company has removed over 4,216,000 cu yds of gravel from the Umpqua River since 1949 with an annual average (between 1965 and 1970) of 239,868 cu yds [26].

Umpqua Bay

Table 9. Commercial Harvest of Shad, Striped Bass, Crabs, and Clams at Umpqua Bay, 1969, 1970, and 1971 [20,118].

| Species | 1969 | | 1970 | | 1971 | |
|-----------------------------|---------------|-----------------|---------------|-----------------|---------------|--------------------|
| | pounds landed | fishermen value | pounds landed | fishermen value | pounds landed | fishermen value |
| Shad ⁽¹⁾ | 374,000 | \$40,000 | 394,018 | \$52,000 | 246,968 | \$34,000 |
| Striped Bass ⁽¹⁾ | 19,481 | 3,000 | 35,473 | 6,000 | 56,321 | 9,000 |
| Crabs ⁽²⁾ | | | 23,049 | | 2,417 | 700 ⁽³⁾ |
| Clams ⁽²⁾ | 9,384 | | 10,631 | | 7,459 | 1,000 |

¹Source of reference [20]; data for the Umpqua River system.

²Source of reference [118]; data for Umpqua Bay.

³Determined as a percentage of the total value of crab landings given in Table 10.

Table 10. Commercial Harvest of Food Fish Received at Winchester Bay, 1971⁽¹⁾ [34].

| Species | Harvest (pounds round weight) | fishermen value |
|----------------|----------------------------------|-----------------|
| Groundfish | 4,561,702 | \$375,000 |
| Crabs | 809,070 | 283,000 |
| Coho | 781,611 | 245,000 |
| Shad | 246,968 | 34,000 |
| Shrimp | 81,330 | 10,000 |
| Striped Bass | 56,321 | 9,000 |
| Chinook | 26,377 | 15,000 |
| Albacore Tuna | 13,766 | 4,000 |
| Clams | 7,459 | 1,000 |
| Smelt | 5,976 | 2,000 |
| Pinks | 1,580 | — |
| Green Sturgeon | 50 | — |
| Totals | 6,592,210 | \$978,000 |

¹Includes data presented in Table 9.

Umpqua Bay

A study to determine the extent of replenishment of the removed gravel was completed by CH₂M/Hill in June 1971 [26]. Use of the channel systems for transport of sand, gravel, and rock, as described under "Physical Alterations" has been especially extensive on the Umpqua River [88].

Recreational

As with commercial fishing, Winchester Bay also serves as the center for the sport fishing, having numerous facilities, docks, and marinas for all types of boats. Facilities for salmon angling are provided at Salmon Harbor on the bay where coho and chinook can be caught from June through September. Salmon fishing on the Umpqua River is good from its mouth to the dam at Winchester located at mile 7.0 of the North Umpqua River or 118.7 miles from the ocean. Chinook can be taken from the river from mid March through June, and coho enter it after the fall rains and provide their best angling in the sections near the towns of Scottsburg at mile 27.5 and Umpqua at mile 102.7 [58,97].

Species other than salmon and trout most commonly caught by sportsmen at Umpqua Bay, as determined in the FCO study from March to October 1971, include tomcod, redbtail perch, and shiner perch by shore angling; striped bass (caught mainly in the upper bay), dungeness crab, and relatively few redbtail perch by boat angling; and softshells by clamming [38]. The softshell clams are found mostly in the tidal flats near the northern bend in the estuary (approximate river mile 5) where near optimum conditions for them exist [155]. Additional species commonly taken include green and white sturgeon, shad, and gaper clams. The sturgeon are caught primarily in the upper bay and the gaper clams in Winchester Bay [79,155]. Annual harvest data for some of the above mentioned fish are given in Table 11.

Table 11. Estimated Annual Harvest Data For Sport Fishing at Umpqua Bay⁽¹⁾ [79].

| Species | area fished | annual harvest (total number) | effort (angler-days) | gross expenditures |
|--------------|--------------|-------------------------------|----------------------|--------------------|
| Salmon | Estuary | 3,000 | 7,500 | \$ 222,000 |
| | Umpqua River | 13,000 | 52,000 | 962,000 |
| | Smith River | 500 | 2,000 | 37,000 |
| | Ocean | 57,000 | 50,000 | 4,255,000 |
| Steelhead | Umpqua River | 8,000 | 32,000 | 592,000 |
| | Smith River | 1,300 | 5,200 | 96,000 |
| Shad | Umpqua Basin | 2,750 | 1,500 | 27,750 |
| Striped Bass | Umpqua Basin | 5,000 | 12,000 | 222,000 |
| Sturgeon | Umpqua Basin | 600 | 2,000 | 12,000 |
| Bay fish | Umpqua Basin | 60,000 | 10,000 | 60,000 |

¹Average of data from past years.

Umpqua Bay

The band-tailed pigeons found on the tidal flats reportedly provide excellent shooting [79].

The Umpqua Lighthouse State Park is located 5 miles south of Reedsport near the estuary mouth, and there is another state park (Umpqua Wayside) on the Umpqua River near mile 23. The former has day-use and camping facilities while the latter is for day visitors only. Attendance figures show that, while camper use at Umpqua Lighthouse has been fairly constant since 1966, the number of day visitors has dropped nearly 90%. The situation at Umpqua Wayside has been an increase in use from 1966 to 1968 followed by a rapid decrease. Some attendance figures for the two parks are given in Table 12 [58,82,83]. Windy Cove Park, which is a Douglas County campground, is located at Salmon Harbor [58].

Table 12. Umpqua Lighthouse and Umpqua Wayside Annual Attendance [82,83].

| Park Users | Umpqua Lighthouse | | Umpqua Wayside | | |
|---------------|-------------------|--------|----------------|---------|--------|
| | 1966 | 1970 | 1966 | 1968 | 1970 |
| day visitors | 478,166 | 48,367 | 88,632 | 111,380 | 38,264 |
| camper nights | 24,637 | 24,690 | — | — | — |

Umpqua Bay

Table 13. Surveillance stations at Umpqua Bay.

| type of station | name and/or identifying number | approximate location | drainage area (sq mi) | period of record | references |
|------------------------|--|--------------------------------|-----------------------|------------------------------------|--------------------------|
| climatological | Gardiner; USGS #9940 | elevation--15 feet | | 1889-1914 | [92] ¹ |
| | Reedsport; USGS #7082 | elevation--94 feet | | 1937* | [92,99,143] ¹ |
| | Elkton 3 SW; USGS #2633 | elevation--114 feet | | 1937* | [92] ¹ |
| | Elkton 4 S; USGS #2637 | elevation--170 feet | | 1950*1956 | [92,99] ¹ |
| | Gunter | Smith River | | 1940* | [99] |
| stream gaging | Umpqua River at Scottsburg; USGS #3229 | Umpqua River; mile 30 | 4,095 | 1966- | [98] ² |
| | Umpqua River near Elkton; USGS #3210 | Umpqua River; mile 56.8 | 3,683 | 10/05-(1970) | [98,99,140] ² |
| | Smith River near Gardiner; USGS #3231 | Smith River; mile 28.5 | 206 | 1966-(1970) | [98,140] ² |
| DEQ water surveillance | #1 | red buoy #6 | | 5/57-(4/72) (25 measurements) | [67,68] ³ |
| | #2 | Double Cove Point | | " | " |
| | #3 | 4 mile green light | | " | " |
| | #4 | red buoy #20 | | " | " |
| | #5 | Highway 101 bridge | | " | " |
| | #6 | 1 mile up Smith River | | " | " |
| | #7 | 1 mile east of railroad bridge | | " | " |
| water quality | Umpqua River near Elkton | Umpqua River; mile 56.8 | 3,683 | 12/65-(9/68) (1 sample monthly) | [141] |
| water temperature | " | " | " | 6/47-(1968) | [138,141] |

¹ Precipitation data available in punch card or printout form through the OSWRB.

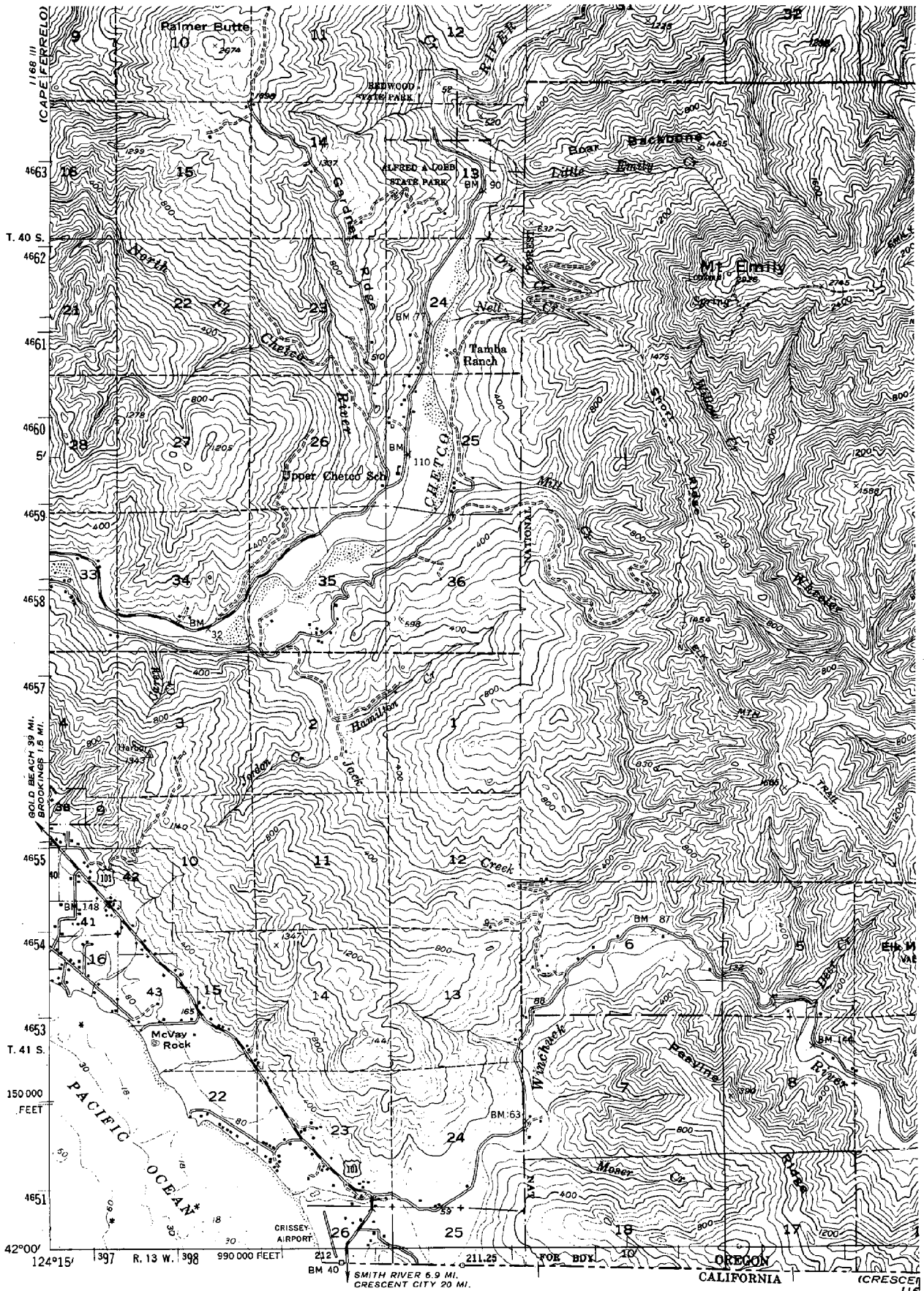
² Monthly and water-year runoff records have been compiled and are available in punch card or printout form through the OSWRB.

³ Data available in punch card or printout form through the DEQ.

() This is the most recent record date found and is not necessarily the last.

* Period of record is not continuous.

WINCHUCK RIVER



WINCHUCK RIVER

General Description of Estuary and Drainage Basin

Estuary

The Winchuck River Estuary lies approximately 294 miles south of the Columbia River mouth and 1/2 mile north of the Oregon-California state line. It is the smallest estuary in terms of surface area of those included in this report. The population in the area is rural, the closest communities being Harbor and Brookings, Oregon which are 2 miles to the north (see Chetco River Estuary for populations of these communities).

The HW surface area of the estuary as estimated from 1973 EROS Data Center aerial photographs is 130 acres [135].

The average annual yield of the Winchuck River is 62,400 ac-ft. Minimum recorded flow was in September, 1934 when 3 cfs was recorded for the Winchuck River above the mouth of the South Fork.

The Winchuck River source is at river mile 8 of the East Fork (approximately 20 river miles from the mouth) at elevation 1,920 feet [93,96].

Average wind direction in the vicinity of Brookings, Oregon during the period from 1937 to 1942 was as follows: November, December, January, February, and March--northeast; April, May, and June--northwest; July and August--south; September--northwest; October--north [7].

Drainage Basin

The Winchuck River drains a total basin area of 70 sq. miles. The Winchuck River Basin consists primarily of woodlands (95.2%; 36,372 acres), cropland (1.4%; 538 acres), and pasture (2.6%; 990 acres). As of January, 1963, the Winchuck River had no existing storage ponds or reservoirs, with 3 possible reservoir sites being studied [93].

The average annual precipitation ranges from 80 inches at the mouth of the Winchuck River to 105 inches in the upper reaches.

The only climatological station near the Winchuck River estuary is the Brookings station which has precipitation and temperature data from 1912 to the present.

The Winchuck River has a length of 12.0 miles, the East Fork having a length of 8.0 miles. The elevation drop from source to mouth is 160 feet for the Winchuck River and 1,760 feet for the East Fork Winchuck River. The average gradient for the Winchuck River is 13 feet per mile and 230 feet per mile for the East Fork [93,96].

Winchuck River stream profile appears on page 43 in the Chetco River Basin section.

WINCHUCK RIVER

Hydraulic Description of Estuary

Tides and Currents

According to the U.S. Geological Survey the average range of the tide is approximately 5 feet [144].

River Discharges

Stream flow records are available from the USGS stream gaging station on the Winchuck River above the South Fork near Harbor. The station is discontinued, but spot observations were taken in 1935, 1936, and 1949-1952. Stream flow averages and extremes appear in Table 1 [148].

Table 1. Stream Gaging Data [148].

| Stream | Location | Drainage area (sq.mi.) | Complete water years of record | Flowrate (cfs) | | |
|-------------------|-----------------------|------------------------------|--------------------------------------|----------------|------|------|
| | | | | max. | min. | mean |
| Winchuck River | T415, R13W Sec. 24 | --- | --- | 13.7 | 5.4 | 10.6 |

Salinity and Classification by Mixing

Salinity profiles as a function of depth and distance from the mouth of the river are presented in Table 2. Data was taken on August 23, 1973 during a high tide of +4.8 feet [87].

Sediments

From Brookings south the coast is flat, with some beach, and the upland is agricultural with many farms to the Oregon-California border.

According to the National Shoreline Study by the U.S. Army Corps of Engineers (Aug., 1971), the shoreline from the Chetco River Estuary to the Oregon-California border is experiencing no erosion [125].

The generalized sediment yield for the Winchuck River basin is 0.1 to 0.2 ac-ft per sq. mile per year [23].

WINCHUCK RIVER

Table 2. Salinity Values for the Winchuck River Estuary. Aug. 23, 1973 [87].

| Station | Distance from mouth (mi.) | Salinity % | | Depth (ft.) |
|---------|------------------------------------|------------|--------|----------------|
| | | top | bottom | |
| 1 | 0.1 | 12.3 | 12.3 | 1 |
| 2 | 0.2 | 2.0 | 10.4 | 6 |
| 3 | 0.3 | 2.4 | 6.6 | 6 |
| 4 | 0.4 | 2.4 | 10.4 | 6 |
| 5 | 0.5 | 2.5 | 9.0 | 3 |
| 6 | 0.6 | 3.0 | 10.4 | 3.5 |
| 7 | 0.8 | 4.3 | 10.4 | 4.5 |
| 8 | 1.0 | 6.6 | 6.6 | 3 |
| 9 | 1.2 | 0.2 | 0.2 | 0.5 |

Water Quality Information

Miscellaneous flow and temperature measurements for the basin were made by the Oregon State Game Commission. Temperature ranges from these sources are presented in Table 3 [78].

DEQ water quality stations are listed in Table 5.

Biological Information

Estimates of the number of adult anadromous salmonids spawning in the Winchuck River system are as follows: spring chinook--none, fall chinook--400; coho--50, steelhead--1,500 and sea-run cutthroat--1,500.

Dace, cottids, red-sided shiners, sticklebacks, lamprey, and suckers are the known rough fish species in the stream systems of the South Coast Basin.

WINCHUCK RIVER

Table 3. Temperature Extremes for the
Winchuck River Drainage Basin [78].

| Point of measurement | Period of record | Observed Temperature Extremes (F°) | | |
|--|-----------------------|---------------------------------------|------|---------------------|
| | | max | min. | type of observation |
| Winchuck River below Moser Cr. | 4-10-69 to 7-23-69 | 70 | 55 | spot |
| Winchuck River above Bear Cr. | 5-8-69 to 7-23-69 | 70 | 56 | spot |
| Bear Creek below Bridge Cr. | 4-10-69 to 7-23-69 | 63 | 49 | spot |
| Wheeler Cr. 100 yds. above mouth | 4-10-69 to 7-23-69 | 68 | 52 | spot |
| East Fork Winchuck River mouth | 4-10-69 to 7-23-69 | 70 | 52 | spot |
| East Fork Winchuck River above Fourth of July Creek | 4-10-69 to 7-23-69 | 66 | 50 | spot |
| Fourth of July Creek mouth | 4-10-69 to 7-23-69 | 67 | 52 | spot |

Biological Information

The streams in this basin are noted for their excellent spawning gravel. The Winchuck River system has 6 streams used by adult anadromous salmonids, 5 of which have minimum flow recommendations established and 1 protected by the State Water Resources Board. The entire stream of Bear Creek (Winchuck R.) should be protected from gravel removal [78].

Table 4 refers to the estimated sport harvest in the Winchuck River system.

Figure 1 is a periodicity chart showing when adult spawning anadromous fish are present in the Winchuck River system.

A general description of big game, upland game, waterfowl, and furbearers of the basin is given in the Sixes River section on Biological Information.

WINCHUCK RIVER

Figure 1. Periodicity Chart for Adult Spawning
Anadromous Fish in the Winchuck River System [78].

Chinook Salmon *****

Coho Salmon -----

Steelhead and
Cutthroat trout ::::::::::::::

| Stream | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | April | May |
|---------------------------|-------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Winchuck River | ***** | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: |
| Bear Creek | ***** | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: |
| Wheeler Creek | ***** | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: |
| Winchuck River, East Fork | ***** | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: |
| Fourth of July Creek | ***** | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: | :::::::::::::: |

Physical Alterations

The only physical alteration near the estuary is the Oregon Coast
Highway Bridge (U.S. 101), at river mile 0.6 [96].

WINCHUCK RIVER

Table 4. Estimated Annual Harvest, Angler Days, and Gross Expenditures for Angling in the Winchuck River System [78].

| Fish | Harvest | Angler Days | Gross Expenditures |
|-------------------|---------|-------------|--------------------|
| Salmon * | 450 | 1,800 | \$33,300 |
| Steelhead | 350 | 1,400 | 25,900 |
| Sea-run Cutthroat | 200 | 80 | 1,480 |
| TOTALS | | 3,280 | \$60,680 |

* Includes jack salmon

Estuary Uses

Industrial and Commercial

The only industrial or commercial use of the Winchuck River is for the purpose of irrigation. The average annual yield for the river is 62,400 ac-ft. The maximum legal annual depletion consumptive rights are 120 ac-ft for domestic purposes and 450 ac-ft for irrigation purposes totalling 570 ac-ft. The river has one reservoir right for irrigation purposes with a storage capacity of 1 ac-foot and a surface area of 1 acre. Surface water rights total 1.55 cfs for domestic and irrigation use [42].

The nearest population centers are Harbor and Brookings. Manufacturers for these areas are listed in Table 3 of the Chetco Bay report.

Recreation

The Pacific Ocean is the principal attraction of the basin. Sport fishing at Brookings to the north is becoming increasingly popular. Fishing in the Winchuck River system is also quite common while the forested areas in the upper basin provide excellent hunting.

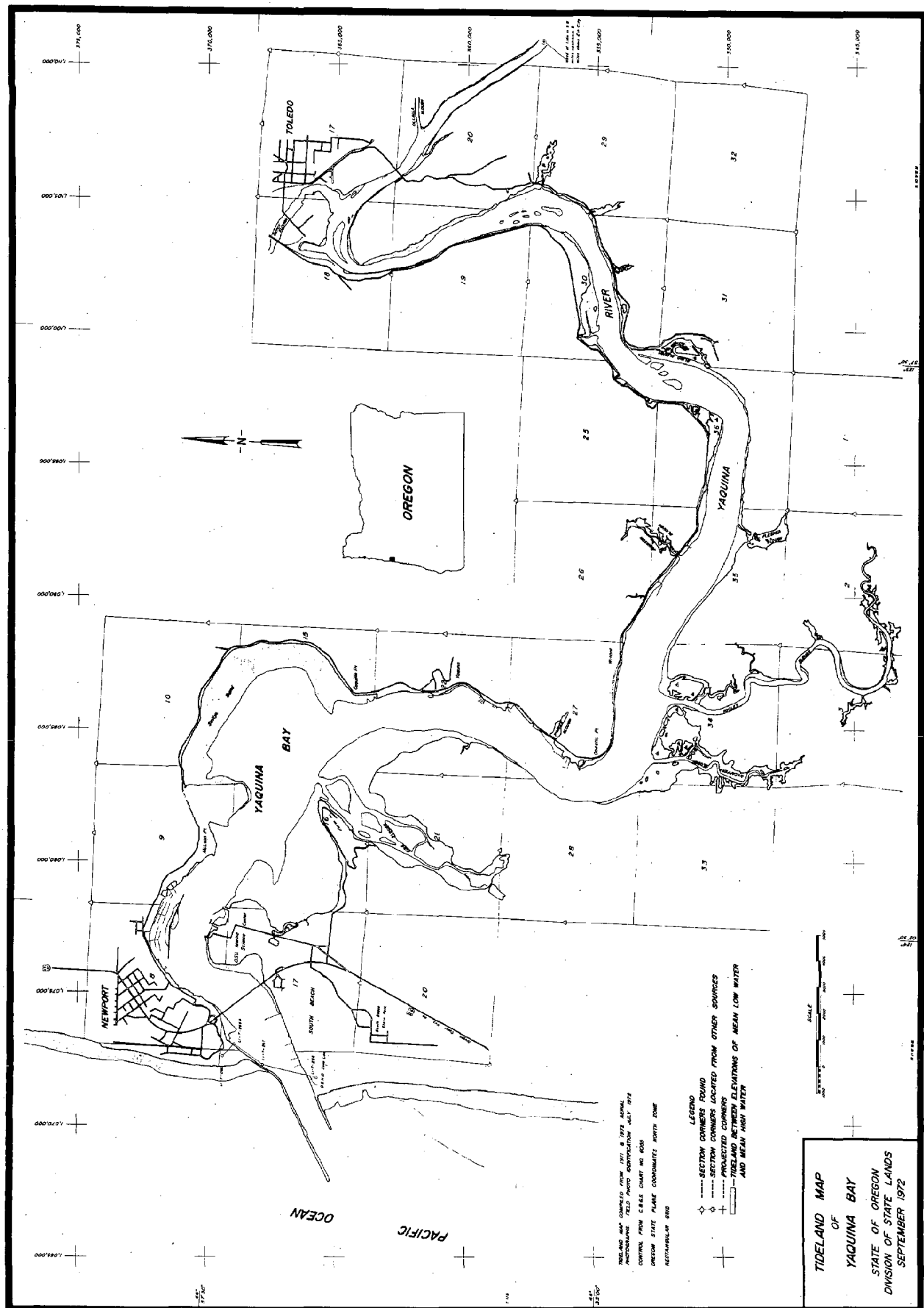
Parts of the Winchuck River flow through the Siskiyou National Forest in both Oregon and California. Several streams in the basin have outstanding aesthetic value and make a significant contribution simply because they maintain attractive flows, have little streamside development, and possess watersheds which have not been excessively logged. The entire Winchuck River was selected by the Oregon State Game Commission as a stream which should be managed for its aesthetic value [78].

WINCHUCK RIVER

Table 5. Surveillance Stations
near the Winchuck River.

| Type of station | Name and/ or identifying number | Approximate location | Drainage area (sq.mi.) | Period of record | Reference |
|-----------------|--|-----------------------------------|------------------------|----------------------|-----------|
| Climatological | Brookings (formerly Harbor) | T145, R13W Sec. 7 | --- | 1912 to present | [93] |
| Water Quality | Winchuck River 1.3 mi. above Hwy. 101 Bridge | T415, R13W Sec. 24 river mile 2.5 | --- | | [152] |
| Stream Gaging | Winchuck River above S.Fk. near Harbor | T415, R13W Sec. 24 | --- | 1935, 1936 1949-1952 | [148] |

YAQUINA BAY



YAQUINA BAY

General Description of Estuary and Drainage Basin

Estuary

Yaquina Bay lies about 115 miles south of the mouth of the Columbia River. Of the estuaries included here, it is fourth in size (Table A). The only incorporated towns on the estuary itself are Newport and Toledo, which are listed in Table 1 with other population centers in the area. There is also a U.S. Coast Guard Station on the north side of the Yaquina River at mile 1.2.

Table 1. Population centers at Yaquina Bay¹ [94,111].

| name | general location | river mile location | 1970 population |
|----------------------|---------------------------|---------------------|-----------------|
| Newport ² | Yaquina River; north side | 0.7 to 1.8 | 5,188 |
| South Beach | Yaquina River; south side | 2.5 | 300 |
| Yaquina | Yaquina River; north side | 4.3 | 50 |
| Winant | Yaquina River; north side | 6.8 | not listed |
| Oysterville | Yaquina River; south side | 6.8 | not listed |
| Moody | Yaquina River; north side | 11.2 | rural |
| Toledo ² | Yaquina River; north side | 12.2 to 13.5 | 2,818 |
| Elk City | Yaquina River; south side | 22.2 | 25 |
| Pioneer | Yaquina River; north side | 25.0 | not listed |
| Chitwood | Yaquina River; north side | 30.9 | rural |

¹Tidal effects extend approximately to mile 26 of the Yaquina River.

²Incorporated

Surface areas of Yaquina Bay reported by Johnson [55], Marriage [59], and the Division of State Lands [70] are shown in Table 2. Tidelands

Table 2. Reported surface areas of Yaquina Bay [55,59,70].

| reference | surface area (acres) | measured at | tidelands | | submerged | lands |
|-----------|----------------------|-------------|-----------|---------|-----------|---------|
| | | | acres | percent | acres | percent |
| [55] | 4,233 | HW | | | | |
| | 3,239 | MSL | | | | |
| | 2,245 | LW | | | | |
| [59] | 2,853 | 1 | 1,751 | 61 | | |
| [] | 3,910 | MHT | 1,353 | 35 | 2,557 | 65 |
| | 2,557 | MLT | | | | |

¹Specified by Marriage as the area affected by tidal action.

Yaquina Bay

(also given in Table 2) cover between 35% and 61% of the total area and are mostly within three tide flats at Sally's Bend, King's Slough, and the area between Idaho Point and the Marine Science Center [59,69,70]. Other estuary dimensions are given in Tables 3 and 4.

Table 3. Dimensions of Yaquina Bay [55].

distance from throat to
farthest estuary shore--6.7 miles

inlet dimensions at throat (at MSL):
width--1,000 feet
average depth--19.6 feet
cross-sectional area--19,610 sq ft

Table 4. Cross-sectional areas of Yaquina Bay [43].

| point of measurement | distance from mouth (miles) ¹ | cross-sectional area (sq ft) |
|----------------------|---|---------------------------------|
| Newport | 1.9 | 35,000 |
| river's bend | 5.5 | 20,600 |
| G. P. dock | 10.7 | 8,900 |
| Mill Creek | 15.2 | 3,700 |
| Elk City | 22.4 | 1,200 |

¹Mile values were obtained by conversion from the distances reported in feet.

The estuary is comprised primarily of its major tributary, the Yaquina River, which has its zero mile at the mouth of the bay. The river drains 253 sq mi and is relatively short with a length of 58.8 miles to its source. From its mouth to the head of high tide at mile 26, it has one major tributary (Elk Creek at mile 22.3) and about 30 smaller creeks and sloughs discharging into it. Elk Creek is 29.7 miles in length and drains 136 sq mi [88-map, 94].

Information concerning land use and ownership at Yaquina Bay has been presented in "Preliminary Land Use Plan for the Yaquina Bay Area" (1969) prepared by the Bureau of Government Research and Service, University of Oregon for the Yaquina Bay Planning Commission [122]. Much of the material from that publication has been included here.

Two port commissions serve the area. The Port of Newport (P.O. Box 921, Newport 97365; 265-7758) is responsible for that section of the estuary from its mouth to just beyond Oneatta Point at mile 5.5. The remaining

Yaquina Bay

navigable portion of the Yaquina River is under the jurisdiction of the Port of Toledo (P.O. Box 370, Toledo; 336-2221 and 336-2552). The Lincoln Development Corporation is located at #2 Dodd Building, 155 East Olive St., Newport 97365; 265-2271.

A relatively large number of scientific studies have been conducted in Yaquina Bay, and reports may be available at the Oregon State University Marine Science Center at Newport.

Drainage Basin

The 253 sq mi drainage basin yields an average of 780,000 ac-ft of fresh water annually [53,85,88]. It consists of 87% (222 sq mi) forests; 4% (9 sq mi) cropland; 2% (4 sq mi) rangeland; and 7% (18 sq mi) "other" [88].

Annual rainfall averages from 60 inches along the coast to 100 to 110 inches in the eastern portions [53,55]. Precipitation records from the Newport climatological station (Table 10) are available through the OSWRB in punch card or printout form [92,143], and wind roses are also available for that area. Winds are primarily from the east and southeast during January and from the west and northwest during June [7].

Elevations range from sea level to 2,300 feet [88].

Hydraulic Description of Estuary

Tides and Currents

The bay is described as being moderately exposed to waves at the throat [88]. Tidal influences extend as far as mile 26 of Yaquina River and "several miles" up Elk Creek [43,88]. The mean tide range is 5.9 feet with a diurnal range of 7.9 feet [55] and an extreme range of 11.5 feet [86]. Tidal prism on mean range is 8.35×10^8 cu ft with a diurnal range of 11.5×10^8 cu ft [55].

In a study by Goodwin, it was found that (1) amplification of the entrance tidal range occurs throughout the estuary and (2) a phase difference of 90 to 100 degrees exists between tidal elevations and tidal currents [43]. A calibrated numerical tidal hydraulic model of the Yaquina has been provided by Goodwin [42].

Currents off Newport are quite variable and reportedly exhibit the characteristics of a large eddy [7].

Yaquina Bay

River Discharges

There are apparently no stream gaging stations on the Yaquina River (at least no records were found), but its normal flow rate has been estimated at 1,078 cfs [86]. Mill Creek, which flows into the Yaquina River from the south at mile 14.9, has a stream gaging station near its mouth where the drainage area is about 4 sq mi (Table 10). Average discharge for the 11-year period from October 1959 to October 1970 was 2.10 cfs with extremes of 609 cfs (January 27, 1965) and 0 (September and October 1961 and September 1962) [140].

Salinity and Classification by Mixing

In the study by Burt and McAllister, salinity measurements were taken in the Yaquina River during October, November, December 1957 and January, February, April, May, July 1958 for a total of 11 test dates [12]. The furthest point from the estuary mouth where salinity was detected was mile 19.8 on October 1 and 27, 1957 and on July 7, 1958 at HHW. Of these three dates, concentration was greatest on October 1, 1957 when it was measured at 3.0 ppt on the surface with a concurrent temperature of 18.2°C.

Burt and McAllister also reported that, on the basis of salinity change from top to bottom, the estuary was a well-mixed system in January, August, October, and November and a partly-mixed system in February, April, and May [13].

Surface and bottom salinity and temperature are provided for two locations over the period January 1963 through August 1970 [37].

A steady state model which used salinity data for a description of mixing was employed by Burt and Marriage to compute potential pollution in the Yaquina [11]. Methods of computing mixing from salinity data were examined by Bella and Grenney [6].

Callaway, et al., [18] observed the longitudinal distribution of salinity, rainfall, and runoff in the Yaquina and demonstrated a rapid decrease in salinity in response to runoff followed by a gradual increase after termination of the runoff input. A more rigorous classification scheme [47] is discussed by Callaway [14] and applied to the Yaquina Estuary above Toledo.

Sediments

Littoral drift in this area is northward in winter and southward in summer with the dominant drift to the north [7]. Drift from both directions either accumulates on the south beach or enters the estuary with the tides; there is little accretion occurring at the north jetty [57]. Sediments deposited in the bay each year by its tributaries total an estimated 30,000 tons [85].

Yaquina Bay

More information on the sediments there is given in a publication by Kulm and Byrne entitled "Sediments of Yaquina Bay, Oregon."⁽¹⁾

Analyses of dredge samples taken from the entrance channel by the U.S. Army Corps of Engineers once in 1958, 1964, and 1970 and twice in 1971 show organic contents ranging from 0.49% (May 1971) to 0.79% (September 1970); void ratios of from 0.5761 (May 1971) to 0.749 (September 1964); and a mean grain size that of fine sand [24].

Water Quality

The DEQ operates 22 water surveillance stations on Yaquina Bay and eight on various sloughs in the area (Table 10) [67,68]. Records from most of the bay stations are available since 1960 with the number of sampling dates ranging from 21 to 93. Turbidity, conductivity, DO, BOD, salinity, PBI, and fecal coliform counts were not always included before 1967. Records from the stations on the sloughs were generally kept from 1967 to 1968 with seven to eleven sampling dates.

A water temperature station is located on Mill Creek near Toledo (Table 10) [138]. Temperatures from November 1959 to September 1969 have been presented as the adjusted average for each month and have ranged from 4°C (January, February, March) to 12°C (August).

The city of Newport operates a secondary sewage treatment plant located on NW 3rd off highway 101 [64]. It presently serves the Newport population; future plans are to include service for the Marine Science Center and some condominiums. Average daily flow at the plant during October 1972 (relatively dry weather) was 900,000 gallons. During rainy weather it ranges from 3 to 5 million gallons.

The city of Toledo also operates a secondary sewage treatment plant [48]. Serving Toledo only, its average flow rate is 750,000 to 800,000 gal/day. It is located at Butler Road and South Fir Street, an area where Georgia Pacific also has a secondary treatment plant [109].

Dissolved oxygen, temperature salinity, and zooplankton populations are provided from January 1963 through August 1970 within Yaquina Bay [37].

The main pollution sources of Yaquina Bay are reportedly at Toledo [29].

1 Kulm, L.D. and Byrne, J.V., "Sediments of Yaquina Bay, Oregon," Estuaries, American Association For the Advancement of Science, 1967.

Yaquina Bay

Biological Information

Estimates of adult anadromous salmonids spawning in the Yaquina River system are as follows: spring chinook--0, fall chinook--2,100, coho--12,600, summer steelhead--0, winter steelhead--2,300, sea-run cutthroat--7,500 [75]. Compared with estimates for other estuarine river systems of Oregon (Table B), these are notably low.

From a list of the fishes of Yaquina Bay, those considered as most abundant include threespine stickleback, striped seaperch, black rockfish, bocaccio, kelp greenling, Ling cod, prickly sculpin, buffalo sculpin, staghorn sculpin, saddleback gunnel, English sole, and starry flounder. Frequently found clams are cockle, softshells, and gaper--the softshells existing mainly in the upper reaches of the bay and the other two in the lower sections. There are some butter and leatherneck clams in the middle reaches and crabs and oysters are also present [38,53,155].

A study was made during 1971 and 1972 in which invertebrates were counted and identified between marker buoy 36 and a point 1.5 miles above marker bouy 47 [154]. Those most often found at given times are as follows:

July-August

1. *Amphisamytha bioculata*
2. *Carophium spinicorne*
3. *Mya arenaria*

August-September

1. *C. spinicorne*
2. *Pseudopolydarna kemp*
3. *M. arenaria*

December

1. *Macoma*
2. *C. spinicorne*
3. *Balanus amphitrite*

April

1. *Macoma*
2. *C. spinicorne*

The bay is used during migration and wintering by black brant, several species of ducks, and shore birds [155]. The area around it is a big game winter range--most commonly for black-tailed deer, and to a lesser degree for Roosevelt Elk, black bear, and cougar. Roosevelt Elk are now being transplanted to the Mid-Coast Basin by the OSGC and are increasing in number [75].

Yaquina Bay

Zooplankton populations and temperature, salinity and dissolved oxygen were collected from January 1963 to August 1970 at close to weekly intervals within Yaquina Bay. The data permits study of year to year variation of abundance and seasonal cycle over 7 1/2 years and can aid in distribution patterns within the Bay [37].

A much more thorough description of the fish and wildlife of Yaquina Bay is given in a special report published in 1968 by the U.S. Department of the Interior, Fish and Wildlife Service [137].

Physical Alterations

Alterations to Yaquina Bay, Harbor and River by the U.S. Army Corps of Engineers, listed in Table 5, consist of two jetties, channels, and turning and small boat basins. Also, studies were in progress as of 1971 to (1) determine the feasibility of deepening the channel between Yaquina and Toledo and (2) consider a potential small boat basin project on the south side of Yaquina Bay [129].

Corps of Engineers records of dredging the entrance bar, inner channel, and Depot Slough from 1959 to 1969 (excluding 1968) show 247,737 cu yds as being fairly typical of quantities removed [55]. That amount was taken from the entrance bar and inner channel in 1962. Navigable length of the Yaquina River is 23 miles [69].

Annual traffic using the channel system during the period from 1960 to 1969 averaged 586,000 tons (Yaquina River) and 349,000 tons (Yaquina Bay and Harbor). In 1969, traffic through the Yaquina River project totaled 358,000 tons and consisted mainly (67%) of rafted logs, followed by lumber, fuel oil, and wastes. Traffic through the bay and harbor project was 133,000 tons (Mainly lumber, paper and paperboard, and petroleum products) [129].

The Division of State Lands has completed its inventory of filled lands in Yaquina Bay and River and has presented its findings in a main report and a supplement to that report [69]. Some information from those 2 papers is given in Table C of the introduction.

Two fishways were completed in 1962 under the FCO "Coastal 60-40 Program." One is the Sloop Creek Fishway located 3 miles above Elk City, or approximately at mile 25, and the other is the Little Elk Creek Fishway at mile 28.2 [119].

Yaquina Bay

Table 5. U.S. Army Corps of Engineers Modifications to Yaquina Bay [122,128,129].

| | Proposed Modification | Location | Dimensions | | | Date and Status (1) |
|--------------------------------|---|--|-----------------|-----------------|------------|--|
| | | | depth (feet) | width (feet) | length | |
| YAQUINA BAY AND HARBOR PROJECT | North Jetty | | | | 6,500 feet | 1896-completed 1934-repaired 1940-extended 1966-repaired and extended |
| | South Jetty | | | | 7,600 feet | 1896-completed 1934-repaired 1971-extended to the same length as the North Jetty |
| | Spur Jetty and 5 groins | Channel Side of South Jetty | | | 800 feet | |
| | Entrance Channel | Entrance | 40 | 400 | | 1968-dredging completed |
| | Channel | Bay (to Newport) | 30 | 300 | | 1968-dredging completed |
| | Turning Basin | Newport | 30 | 900-1,200 | 1,400 feet | 1968-dredging completed |
| | Small Boat Basin | Newport | | | | 1949-completed |
| YAQUINA RIVER PROJECT | Channel | Newport to Yaquina | 18 | 200 | 4.5 miles | 1968-dredging completed |
| | Channel | Yaquina to Toledo | 10 | 150 | 10 miles | 1914-completed |
| | Channel | Depot Creek (2) | | 200 | | 1914-completed |
| | Channel | Near Olalla Creek (2) | 10 | 150 | | 1968-completed |
| | Turning Basin | Near Olalla Creek | 10 | | | 1968-completed |
| | 2 Levees with Tide gates and Pile Bulkheads | 6 miles south-east of Newport; North Bank of the Yaquina River | | | | 1948-completed |

¹Lack of completion date does not necessarily signify that the modification has not been constructed.

²Depot and Olalla Creeks discharge into the Yaquina River at Toledo.

Yaquina Bay

Estuary Uses

Industrial and Commercial

As a major industrial estuary, Yaquina Bay is a center for lumbering and commercial fishing activities [88,122,155]. Recreation is also important to the area and is actually growing at a faster rate than the forest products industry [122]. Manufacturers in the area are listed in Table 6 [71].

Table 6. Major Manufacturers at Yaquina Bay [71].

| Location | Name | Type of Business | Number Employed |
|-----------|---|--|-----------------|
| Newport | New England Fish Co. of Oregon | processing fresh and frozen fish | 100 |
| | Yaquina Bay Fish Co. | fish, salmon, crab, fillet (packaging) | 40 |
| | Point Adams Packing Co. | crab, shrimp processing | 32 |
| | Newport News-Times | weekly newspaper and commercial printing | 20 |
| | 14 manufacturers employing less than 10 | dealing in a variety of products | |
| Toledo | Georgia-Pacific Corp. | paperboard mill | 595 |
| | Georgia-Pacific Corp. | plywood sheathing and lumber, studs | 320 |
| | Cascadia Lumber Co. | lumber | 102 |
| | Toledo Shingle Co. Inc. | shingles and shakes | 45 |
| | Guy Roberts Lumber Co. | sawmill/planer mill | 40 |
| | Toledo Products Inc. | wooden pallets and fish boxes | 26 |
| | Newport-News Publishing Co., Inc. | newspaper and job printing | 20 |
| | 5 manufacturers employing 15 or under | dealing mainly in lumber and wood products | |
| Eddyville | WOW Lumber Co. | lumber | 27 |
| | Three B's Logging Co. | logging | 9 |

Toledo (particularly its south side) is the focal point of the forest industry processing facilities not only for the estuary and county (Lincoln) [122], but for the entire Mid-Coast Basin [88]. Most of the major industries there, included in Table 6, are concerned with forest products. The only lumber mill in the estuary area not in Toledo is located at Eddyville (river mile 36.3) [122]. In addition to the manufacturing of wood products, log storage and lumber shipping are also important [155]. Statistics of use of the Yaquina Bay and River projects (presented under "Physical Alterations") show that much of the traffic using the channel systems

Yaquina Bay

consists of rafted logs, lumber, and wood products [129]. Log rafts are under the jurisdiction of the Port of Toledo; total area of the estuary used for their storage could be determined by contacting the industries listed in Table 6 [105,109].

While Toledo is the center of the forest products industry in the Mid-Coast Basin, Newport is the center for commercial fishing activities-- in 1967 there were 450 commercial fishing boats licensed as being moored at Newport [122], and there are numerous fish processing plants there (Table 6). During 1971 commercial landings from the estuary itself were fairly limited (Table 7), but those from the entire area received at Newport (Table 8) were greater than at any of the other estuaries included

Table 7. Commercial Harvest of Clams, Crabs, and Oysters From Yaquina Bay [75,118].

| Species | 1969 | | 1970 pounds landed | 1971 pounds landed |
|---------|------------------|--------------------|--------------------------|--------------------------|
| | pounds landed | fishermen value | | |
| Oysters | 47,530 | \$56,000 | | |
| Crabs | 15,000 | 3,750 | 29,071 | 5,906 |
| Clams | 1,581 | | 444 | 1,819 |

Table 8. Commercial Harvest of Food Fish Received at Newport, 1971¹ [34].

| Species | Harvest (pounds round weight) | Fishermen value |
|----------------|-------------------------------------|--------------------|
| Crabs | 3,624,105 | \$1,087,000 |
| Shrimp | 3,601,879 | 431,000 |
| Groundfish | 2,369,197 | 195,000 |
| Coho | 1,695,469 | 531,000 |
| Albacore Tuna | 998,262 | 302,000 |
| Chinook | 104,876 | 63,000 |
| Oysters | 39,560 | 81,000 |
| Green Sturgeon | 9,599 | 1,000 |
| Clams | 2,039 | |
| Pinks | 1,848 | 1,000 |
| Smelt | 350 | |
| Totals | 12,447,184 | \$2,692,000 |

¹Includes 1971 data presented in Table 7.

Yaquina Bay

here (Tables D and E). In fact, of the entire Oregon coast, the landings received at Newport were exceeded only by those received at Astoria [34].

Recreational

Sport fishing is popular, as indicated by the estimated annual harvest data for salmon, sea-run cutthroat, steelhead, and non-salmonid bay fish presented in Table 9 [75]. Deep sea boats make regular and chartered trips

Table 9. Estimated Annual Harvest Data For Sport Fishing At Yaquina Bay(1) [75].

| Species | area fished | annual harvest (total number) | effort (angler-days) | gross expenditures |
|-----------------------|---------------|-------------------------------|----------------------|--------------------|
| Salmon | Estuary | 2,240 | 9,000 | \$ 165,760 |
| | Yaquina River | 560 | 2,240 | 41,440 |
| | Ocean | 41,600 | 61,800 | 3,078,400 |
| Sea-run Cutthroat | Estuary | 540} | 2,700 | 49,950 |
| | Yaquina River | 540} | | |
| Steelhead | Yaquina River | 200 | 1,600 | 14,800 |
| Non-salmonid bay fish | Estuary | 77,000 | 28,750 | 172,500 |

1Average of data from past years.

on the ocean from May through September. The best time for chinook and coho angling in the estuary is during August [58].

Clams most commonly taken from the bay, as determined in the FCO study from March to October 1971, are cockle, softshell, and some gaper [38]. Cockle and gaper clams are found in the lower sections and softshells in the upper reaches.

Most of the recreation sites in the area are along the coast. One of these is Yaquina Bay, a state park for day use only located north of the estuary mouth. Statistics for 1966 to 1970 show a steady increase in the number of visitors there from 974,469 to 1,335,905. A county park is located at Elk City, and within tidewater there are six private boat landings and five charter boat services [82,122].

A plan for water access in the Yaquina River Basin entitled "Yaquina River Basin, Master Plan for Angler Access and Associated Recreational Uses" published by the OSGC in November 1968 is described in the paper, "Preliminary Land Use Plan for the Yaquina Bay Area" which was mentioned briefly in the first section of this report [122].

Table 10. Surveillance stations at Yaquina Bay.

| type of station | name and/or identifying number | approximate location | drainage area (sq mi) | period of record | references |
|-----------------|--------------------------------|---|-----------------------|-----------------------------------|--------------------------|
| climatological | Newport; USGS #6032 | | 136 | 1837-(1968) | [88,92,143] ¹ |
| | #11 | Newport Bridge (Highway 101) | | 8/60-(3/72) (31 measurements) | [67,68] ^{2,3} |
| | #12 | McLean Point | | 8/60-(3/72) (32 measurements) | " |
| | #13 | Coquille Point | | 8/60-(3/72) (30 measurements) | " |
| | #1 | channel #17 (near west bank) 600 yards south, 400 yards west | | 3/60-(12/69) (60 measurements) | " |
| | #2 | flashing light #17, 100 yards south | | 3/60-(7/69) (62 measurements) | " |
| | #3 | Weiser Point, 275 yards; #19 marker | | 3/60-(3/72) (68 measurements) | " |
| | #4 | Oneatta Point, 275 yards north, 400 yards west; #21 marker | | 3/60-(4/72) (85 measurements) | " |
| | #5 | flashing light #25 | | 3/60-(4/72) (84 measurements) | " |
| | #6 | red channel buoy #26 | | 3/60-(4/72) (89 measurements) | " |
| | #7 | Oregon Oyster Co. plant, 100 yards south, 500 yards east | | 3/60-(4/72) (87 measurements) | " |
| | #8 | red channel buoy #28 | | 3/60-(4/72) (85 measurements) | " |
| | #9 | flashing light #32 | | 3/60-(4/72) (93 measurements) | " |
| | #10 | red channel buoy #34; 375 yards north | | 3/60-(9/70) (60 measurements) | " |
| | #14 | red light #42 | | 8/60-(7/69) (23 measurements) | " |
| | #15 | flashing light #47 | | 8/60-(3/72) (31 measurements) | " |
| | #16 | below shingle mill | | 8/60-(7/69) (23 measurements) | " |
| | #17 | shingle mill | | 8/60-(3/72) (31 measurements) | " |
| | #18 | mouth of Depot Slough | | 8/60-(3/72) (30 measurements) | " |
| | #19 | Toledo Bridge | | 8/60-(1/71) (24 measurements) | " |
| | #20 | Cascadia Mill | | 8/60-(7/69) (21 measurements) | " |
| | #21 | Mill Creek at mouth | | 8/60-(3/72) (26 measurements) | " |
| | #22 | Mouth of Otiala Slough | | 1/57-(3/72) (21 measurements) | " |

Yaquina Bay

Table 10. Surveillance stations at Yaquina Bay.

| type of station | name and/or identifying number | approximate location | drainage area (sq mi) | period of record | references |
|------------------------|---|---|-----------------------|-------------------------------------|----------------------|
| DEQ water surveillance | log dump in King Slough, east of Highway 101 | | | 1/67-(9/68) (7 measurements) | [67,68] ² |
| | Peole's Slough, south side of Yaquina River | | | 2/68-(12/68) (7 measurements) | " |
| | Fletcher's Slough bridge, south side of Yaquina River | | | 1/67-(12/68) (10 measurements) | " |
| | Boone Slough bridge near flashing light #37 | | | 6/67-(12/68) (10 measurements) | " |
| | Rutes Slough Bridge west of black channel can #41 | | | 6/67-(12/68) (10 measurements) | " |
| | Depot Slough bridge on Yaquina Bay Road | | | 1/67-(12/68) (10 measurements) | " |
| | Otella Slough bridge, Firecrest Way Drive | | | 1/67-(12/68) (11 measurements) | " |
| | Otella Slough Bridge; Corvallis-Newport Highway | | | 6/67-(12/68) (8 measurements) | " |
| water quality | Yaquina Bay and Yaquina River to Toledo | Yaquina River; mile 4.2 | | 1953-1955 | [88] |
| water temperature | Mill Creek near Toledo; USGS #3055.36 | Mill Creek; mile 2; 17 miles from the estuary mouth | 4 | 11/59-(1965) (spot observations) | [88,138] |

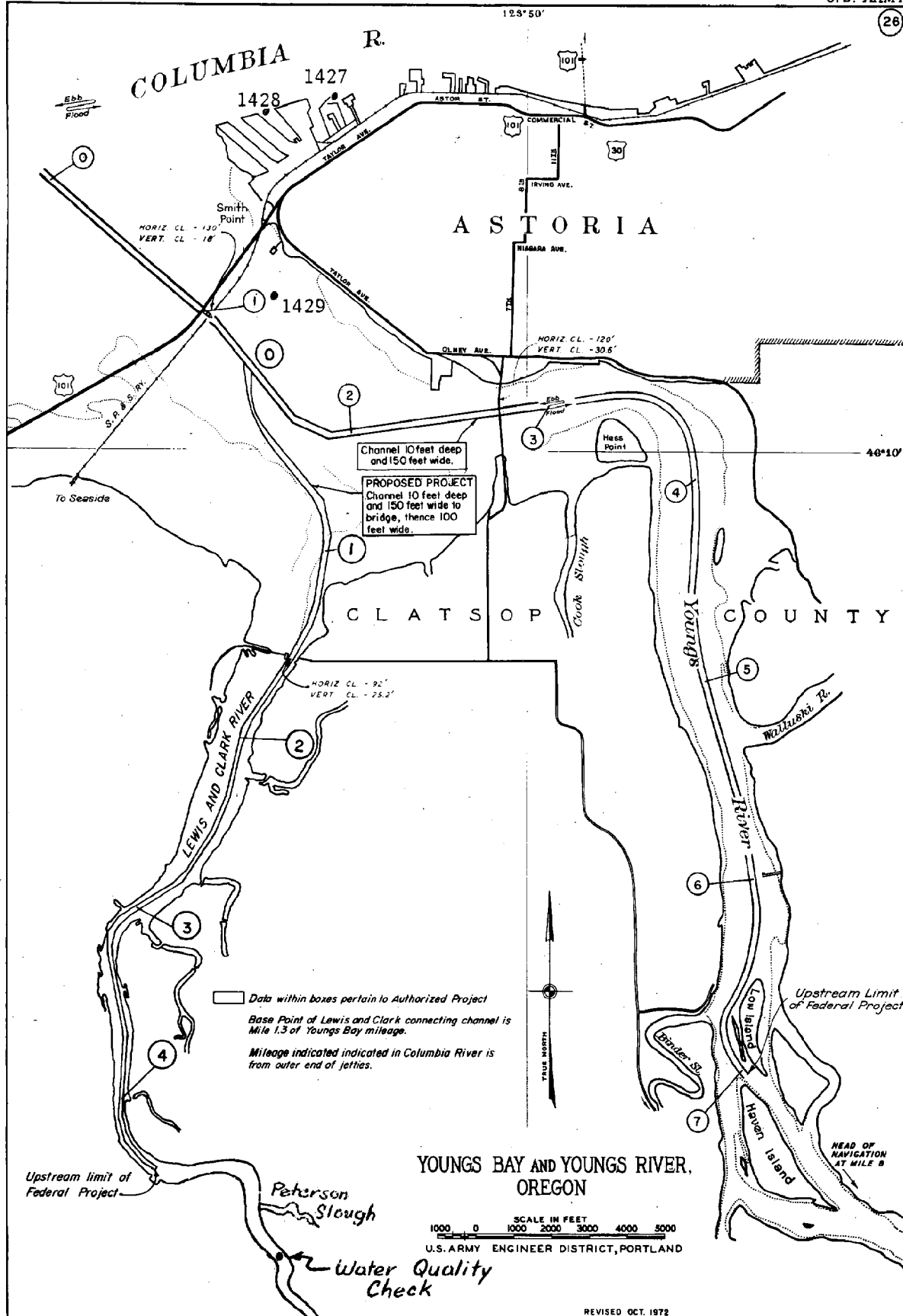
¹Precipitation data available in punch card or printout form through the OSWRB.

²Data available in punch card or printout form through the DEQ

³Records are not complete before 1967.

() This is the most recent record date found and is not necessarily the last.

YOUNG'S BAY



YOUNG'S BAY

General Description of Estuary and Drainage Basin

Estuary

Young's Bay lies approximately 12 miles above the mouth of the Columbia River. Of the estuaries included herein, it ranks 5th in size. Towns located on or near the estuary are Astoria, Miles Crossing, and Warrenton. Locations and 1970 populations are given in Table 1 [9,95, 111,123,129].

Table 1. Population Centers at Youngs Bay
[9,95,111,134].

| NAME | GENERAL LOCATION | RIVER MILE LOCATION | 1970 POPULATION |
|----------------|-----------------------------|------------------------|--------------------|
| Astoria | Columbia R., S. Side | 13 to 15 | 10,244 |
| | Youngs Bay, E. Side | 0 to 3 | |
| Miles Crossing | Lewis and Clark R., E. Side | 3 | (not listed) |
| Warrenton | Skipanon R., W. Side | 0 to 4.3 | 1,825 |
| | Lewis and Clark R., W. Side | 0.4 | |

Tidal reach is approximately 8 miles in Lewis and Clark River [134].

The estuary measures 12,000 feet at its mouth and covers about 2,870 acres. The width converges to approximately 1,800 feet at the Young's Bay Bridge, river mile 2.9 [116].*

The estuary consists of young's Bay and the lower reaches of the Young's, Lewis and Clark, and Skipanon Rivers. The Young's River drains an area of 122 sq. miles with its source at river mile 22.7; elevation 1,040 feet. Tributaries of the Young's River include the Walluski River (length-12.0 miles; source-700 feet) and the Klaskanine River (length-2.8 miles; North Fork-11.1 miles; source 1,350 feet; South Fork-12.1 miles, source-1,240 feet). The mouth of the Walluski River is located on the East bank of the Young's River at mile 1.7 while the Klaskanine River, also on the East bank, is located at mile 6.5. The Lewis and Clark River drains an area of 62 sq. miles with its source at river mile 27.2, elevation 1,920 feet. The Skipanon drains 16 sq. miles with its source at Cullaby Lake, mile 7.8, elevation 10 feet. The source of Cullaby Lake is another 6.7 miles up Cullaby Creek at elevation 150 feet. (Elevations are water elevations based on mean flow with zero occurring at the mouths of each stream) [124].

The Port of Astoria is located at Astoria and can be contacted at P.O. Box 569, Astoria, Oregon, 97103, telephone number 325-4521 [7].

*Dimensions taken from maps included in [116].

YOUNG'S BAY

General Description of Estuary and Drainage Basin

Drainage Basin

The Young's--Lewins and Clark--Skipanon system drains a total basin area of 200 sq. miles. The average yearly freshwater yields of the Young's River is 403,300 ac-ft, with an average annual precipitation of 92 inches; the Lewis and Clark yields 184,700 ac-ft. with 94 inches; and the Skipanon yields 35,900 ac-ft, with 80 inches. Total average yearly freshwater yield of the system is 623,900 ac-ft [133].

The Young's River Basin consists primarily of forests (76.3%; 67,100 acres), cropland (4.8%; 4,200 acres) and rangeland (0.6%; 500 acres). Lewis and Clark River Basin: forests (79%; 34,600 acres), cropland (8%; 3,500 acres), and rangeland (1.6%; 700 acres). Skipanon River Basin: forests (78.1%; 8,180 acres), cropland (8.6%; 900 acres), and rangeland (0.5%; 50 acres). Frequently flooded areas average 600 acres on the Young's River, 400 acres on the Lewis and Clark River, and 200 acres on the Skipanon River. As of June 1966, the Young's River had 3 existing storage ponds with 5 potential reservoir sites being studied; the Lewis and Clark River had 1 existing storage reservoir with 4 potential reservoir sites being studied, and the Skipanon had 4 storage ponds with no studies for future sites. (Reconnaissance data for these possible reservoir sites may be found in reference [133]).

Average annual precipitation ranges from 75 inches at Young's Bay to over 110 inches at the headwaters of the Lewis and Clark.

There are two climatological stations in the Young's Bay vicinity. The Astoria Experiment Station has recorded data from 1918 to the present and Astoria WSO has recorded data from 1953 to the present [143].

Wind roses from Astoria show annually averaged winds to occur from the northwest, west, southwest, south, and southeast, each 15% of the time at speeds from 4 to 31 mph. Wind roses for July indicate winds from the northwest 40% of the time with speeds for 4 to 31 mph [84].

The Young's Bay river profiles appear on page 221 in the Tillamook Basin section.

Hydraulic Description of Estuary

Tides and Currents

The diurnal range of tides is about 8.6 feet and the extreme tidal variation amounts to about 12 feet (mean lower low water is used as the plane of reference). Tides at the mouth of the Columbia River exhibit the diurnal inequality that is typical of the Pacific Coast of North America.

YOUNG'S BAY

Hydraulic Description of Estuary

River Discharges

Stream flow records are available from USGS stream gaging stations on the Young's River and North Fork of the Klaskanine River (Table 8) [146,147]. The Young's River station, located at approximately river mile 9, was discontinued in 1958. The Klaskanine River station, located at approximately river mile 5, was discontinued in 1955. Stream flow averages and extremes for these two stations are given in Table 2A [146,147].

No records of river stage or flow have been kept for the Lewis and Clark River, but based on records for the nearby Young's River, the maximum average monthly discharge is estimated to exceed 600 cubic feet per second [123]. Average monthly flows for the Young's and Lewis and Clark Rivers are given by Oregon State Water Resources Board, 1972, in Table 2B and 2C.

Table 2A. Stream gaging data [146,147].

| Stream | Location (river mile) | Drainage area (sq. mi.) | Complete water years of record | Flowrate (cfs) | | |
|--------------------------|--------------------------|-------------------------------|---|-------------------|------|------|
| | | | | max. | min. | mean |
| Youngs R. | 9 | 40.1 | 31 | 4750 | 3.3 | 178 |
| N. Fork Klaskanine R. | 5 | 14.0 | Aug. 1949 Sept. 1955 | 829 | 1.5 | 66.3 |

Salinity add Classification by Mixing

No information was found for this area.

Sediments

Although quantitative data on the sedimentation rate is lacking, considerable filling of the Lewis and Clark River has been occurring during recent years. The Geological survey reports that a "turbidity maximum" normally develops in the Columbia River estuary (of which Young's Bay and the lower Young's and Lewis and Clark Rivers are part) because of a net circulation pattern in which dense saline water flows landward in the bottom layers and less dense fresher water flows seaward in the surface layers. The turbidity maximum is an area within which concentrations of suspended sediment, including some sand, are substantially higher than they are either downstream toward the mouth of the estuary or upstream in the Columbia River. Sample results taken near Astoria are presented in Table 3.

YOUNG'S BAY

Table 2B. Average Monthly Flows for Youngs River [140]

| | Average Monthly Flows (cfs) | | |
|-----------|--------------------------------|-----|-----|
| | 20% | 50% | 80% |
| October | 176 | 91 | 26 |
| November | 456 | 291 | 138 |
| December | 598 | 389 | 262 |
| January | 571 | 392 | 248 |
| February | 536 | 392 | 254 |
| March | 403 | 286 | 193 |
| April | 273 | 186 | 109 |
| May | 119 | 78 | 48 |
| June | 69 | 46 | 27 |
| July | 29 | 20 | 12 |
| August | 14 | 11 | 8 |
| September | 24 | 12 | 7 |
| Total | | | |

S.M. 7- Correlated with S.M. 9.7 by Area-Precipitation

Area = 36 Sq. Mi.

Area-Precip. = 194,210 Ac.-Ft. [Calculated by SWRB '72]

YOUNG'S BAY

Table 2C. Average Monthly Flows for Lewis and Clark River [140]

| | Average Monthly Flows | | |
|-----------|-----------------------|-----|-----|
| | (cfs) | | |
| | 20% | 50% | 80% |
| October | 241 | 125 | 36 |
| November | 624 | 398 | 189 |
| December | 817 | 532 | 359 |
| January | 780 | 536 | 339 |
| February | 733 | 536 | 347 |
| March | 551 | 392 | 264 |
| April | 374 | 255 | 149 |
| May | 162 | 107 | 66 |
| June | 94 | 63 | 37 |
| July | 40 | 27 | 16 |
| August | 19 | 15 | 10 |
| September | 33 | 16 | 9 |
| Total | | | |

S.M. 4- Correlated with Youngs River at S.M. 9.7 by Area-Precip.

Area= 50 sq. mi.

Area-Precip.= 265,530 AC.- Ft. [Calculated by SWRB '72]

YOUNG'S BAY

Hydraulic Description of Estuary

Table 3. Sediment Quality Characteristics.

| | Sediment Analysis | | | EPA Tentative Criteria |
|---|-------------------|--------|-------|----------------------------|
| | Sample No. * | | | |
| | 1427 | 1428 | 1429 | |
| Particle Size Distribution | | | | |
| Gravel (6 mesh) | 0% | 1% | 0% | No standard established |
| Sand | 70% | 51% | 93% | " |
| Silt & Clay (-200 mesh) | 30% | 48% | 7% | " |
| Chemical Characteristics (Cone % Dry wt.) | | | | |
| Volatile Solids | 4.5 | 4.8 | 2.2 | 6.0% |
| Chemical Oxygen Demand (COD) | 3.8 | 2.7 | 2.0 | 5.0% |
| Initial Oxygen Demand (IOD) | 0.45 | 0.49 | 0.26 | No standard established |
| Oxygen-Reduction Potential | -0.13 | -0.11 | +0.01 | " |
| Sulfides | 0.13 | 0.25 | 0.04 | " |
| Total Phosphorus | 0.78 | 0.84 | 0.74 | " |
| Kjeldahl Nitrogen | 0.084 | 0.118* | 0.049 | 0.10 |
| Oil & Grease | 0.061 | 0.101 | 0.031 | 0.15 |

*Grab sample locations noted on map.

*Exceeds EPA Tentative Criteria [123].

Sediments

According to the U.S. Army Corps of Engineers environmental statement on dredging of the Lewis and Clark connecting channel, the maximum intensifies, abates, and moves back and forth with the tide. It is most fully developed at about the time of peak velocities. The highest sediment concentrations are usually associated with low salinities and develop in the reach where net flow at the bottom is near zero. Maximum deposition often occurs in that area. During moderate river flow, the turbidity maximum develops highest values at about Columbia River mile 9 or 10 (the mouth of Young's Bay being at mile 12) [123].

YOUNG'S BAY

Water Quality Information

Water temperature data was taken at the North Fork Klaskanine River gaging station near Olney, Oregon for the period of May 1950 to September 1954. (Table 8) [145]. Also miscellaneous flow and temperature measurements for the basin were made by the Oregon State Game Commission. Temperature ranges for these sources are presented in Table 4 [77,145].

Table 4. Temperature Extremes for Youngs Bay Drainage Basin [77,145].

| Point of measurement | Period of record | Observed temperature extremes (F°) | | type of observation |
|--|------------------|------------------------------------|---------|---------------------|
| | | maximum | minimum | |
| USGS-- | May 1950 | | | |
| N. Fork Klaskanine 4 mi. SE of Olney, Ore. | Sept. 1954 | 65° | 34° | continuous |
| OSGC-- | Jan. 1971 | | | |
| N. Fork Klaskanine mouth | Aug. 1971 | 66° | 44° | spot |
| S. Fork Klaskanine mouth | " | 67° | 44° | " |
| Youngs R. below Wawa Cr. | " | 71° | 44° | " |
| Lewis and Clark R. below Klickitat Cr. | " | 70° | 44° | " |

Table 5 describes water quality characteristics for the Lewis and Clark River obtained at a site 1/2 mile above Peterson Slough at river mile 4.3, as reported by the Oregon State Department of Environmental Quality. Extensive bottom deposits of bark from log storage may create a physical barrier to the development of a healthy community of benthic organisms [123].

As of December 1967, there were two sewerage works projects needed in the Young's Bay area according to the Oregon State Sanitary Authority. Astoria needed a new sewer system and sewage treatment plant. The preliminary engineering study was underway. Schedule completion was July 1972. Warrenton needed sewer extensions, replacement or improvements and a new sewage treatment plant. As of December 1967, the preliminary engineering study and report had been completed. For further information contact the Oregon State Sanitary Authority [84].

DEQ water quality stations are listed in Table 8.

Table 5. Water Quality Characteristics, Lewis and Clark River
1/2 mile upstream of Peterson slough, river mile 4.3. [123].

| Analysis | 6/3/69 | 8/19/69 | 10/7/69 | 3/10/70 | 4/11/72 |
|--------------------|--------|---------|---------|---------|---------|
| Time | 1230 | 1430 | 1400 | 1215 | 1445 |
| ph (field) | 6.6 | 6.7 | 6.5 | 6.6 | 6.6 |
| temperature | 18.0 | 20.0 | 11.0 | 8.5 | 6.5 |
| Orig. DO | 8.2 | 6.3 | 9.1 | 11.4 | 11.9 |
| Final DO | 7.5 | 5.6 | 8.3 | 10.6 | 10.5 |
| BOD | 0.7 | 0.7 | 0.8 | 1.4 | 1.4 |
| PBI | --- | --- | --- | --- | --- |
| Cond. | --- | --- | --- | 78 | 120 |
| MPN (total) | 2400 | 230 | 230 | 620 | 230 |
| ph (lab) | 6.8 | 7.0 | 6.7 | --- | 6.5 |
| Color | .7 | 10 | 25 | --- | 10 |
| Turbidity | 29 | 7 | 8 | --- | 5 |
| Solids (total) | 91 | 1259 | 112 | --- | 55 |
| Solids (susp.) | 17 | 20 | 19 | --- | --- |
| Alkalinity | 14 | 22 | 13 | --- | 9 |
| Hardness | 20 | 198 | 18.7 | --- | 14.8 |
| SO ₄ | 7.1 | 7.4 | 9.7 | --- | 4.59 |
| NH ₃ -N | 0.11 | 0.07 | 0.06 | 0.05 | 0.04 |
| NO ₃ -N | 0.24 | 0.07 | 0.25 | 0.21 | 0.25 |
| PO ₄ - | 0.03 | 0.08 | 0.05 | 0.03 | 0.02 |
| Cl ⁻ | 8.8 | 594 | 22.4 | --- | 12.2 |
| Na | --- | --- | --- | --- | 6.5 |
| K | --- | --- | --- | --- | 1.5 |
| Fecal Coliform | --- | 230 | 230 | --- | 60 |
| Fecal Strep. | --- | 245 | 62 | --- | --- |

YOUNG'S BAY

Biological Information

Estimates of the number of adult anadromous salmonids spawning in the young's--Lewis and Clark River systems are as follows: fall chinook--500, coho--17,700, chum--200, winter steelhead--2,800, and sea-run cutthroat--1,000. A breakdown appears in Table 6 [77]. Non-anadromous fish include shad, chub, carp, sculpin, dace, and chisel mouth [123].

Table 6. Adult Anadromous Salmonid Spawning Estimate
[77]

| Stream | Chinook | | Coho | Chum | Steelhead | | Sea-run Cutthroat |
|---------------|---------|------|--------|------|-----------|--------|----------------------|
| | Spring | Fall | | | Winter | Summer | |
| Lewis & Clark | --- | 50 | 3,000 | 50 | 750 | --- | 500 |
| Youngs | --- | 50 | 200 | 50 | 50 | --- | 200 |
| Klaskanine | --- | 400 | 14,000 | 100 | 2000 | --- | 300 |

The Oregon State Game Commission recommends that the Lewis and Clark River be protected from gravel removal above the South Fork. It was also determined that possible reservoir sites in the North Fork of the North Fork of the Klaskanine River (T7N-R8W-S17) and Young's River (T7N-R9W-S27) are thought compatible with fishery resources [77].

Species of wil life present in the region in significant numbers are Black-tail deer, Roosevelt elk, marten, fisher, weasel, striped and spotted skunks, raccoon, opossum, bobcat, cougar, nutria, muskrat, mink, and beaver. Many species of waterfowl frequent the regions, primarily as migrants on the Pacific flyway. The most numerous ducks sighted are pintail and scaup. Upland birds include hummingbirds and wrens.

Three major plankton groups were found in the estuary. The freshwater (0.1‰ salinity or less) plankton were dominated by a copepod Cyclops vernalis, and cladocerans, Daphnia longispina and Bosmina spp. Seasonally abundant species included the cladoc rans Diaphanosoma brachyurum (summer), and Ceriodaphnia quadrangula (summer-fall), juvenile amphipods Corophium salmoinis (winter-spring), the rotifers Brachionis spp (summer), and copepod Diaptomus ashlandi (spring and summer). In brackish waters the copepod Eurytemora hirundoides made up 90-100% of the plankton population. In the waters of the salt intrusion, principal species were Acartia clausi, A. longiremus, and Psuedocalanus minutus; while seasonally abundant species included Oithana similis (fall), Acartia tonsa and Corycaeus affinis (fall), and Evadne nordamanni (summer-fall).

YOUNG'S BAY

Physical Alterations

A channel 10 feet deep and 150 feet wide from the Columbia River to the foot of Haren Island, a distance of about 2 1/2 miles across Young's Bay and 4 miles in Young's River, was authorized by the River and Harbor Act of 30 August 1935 and completed in 1938. Project, as modified under Section 107 of the 1960 River and Harbor Act, amended by Section 310 of the 1965 River and Harbor Act, and approved 7 January 1970, provided for a channel in Lewis and Clark River 10 feet deep and 150 feet wide from Young's Bay Channel to the State Highway 105 Bridge to the end of the project, a distance of about 4 1/2 miles. Total federal cost through June 1970 was: \$9,000 construction; \$50,000 maintenance. Estimated federal cost of the Lewis and Clark channel is \$190,000 [129].

Records of bank protection, dock, launch ramp, log dump, piling, cable, wire, and pipe permits in the estuary are kept by the U.S. Army Corps of Engineers, Portland District.

The Skipanon Waterway at the mouth of the Skipanon River was constructed June 1950 and is 30 feet deep [116].

Bridges over the estuary include the U.S. 101 Bridge, the Spokane, Portland, and Seattle Railroad Bridge (horizontal clearance 130', vertical clearance 18') the Young's Bay Bridge, U.S. 26 (horizontal clearance 120', vertical clearance 30.6') and the Oregon Coast Highway Bridge across the Lewis and Clark River (horizontal clearance 92', vertical clearance 25.2') [116,123].

Estuary Uses

Industrial and Commercial

Lumbering, dairying, stock raising, tourism, boat building, and fishing provide the economic base for the region. Seafood processing is an important industry.

The lowlands beside the navigable reaches of the Lewis and Clark River and Young's River are cleared and in agricultural use. Most other lands in the basin are mountainous and are managed for timber productions. Second-growth timber is the principal natural resource of the basin. Existing commerce consists mainly of rafted logs. Table 7 lists major manufacturers in the Young's Bay area [71,116,123].

Recreational

The main recreational activities in the area are fishing, hunting, sightseeing, picnicing, boating, clam digging, and crabbing.

One of the more popular places of interest in the area is the Fort Clatsop National Memorial. The site of Fort Clatsop was preserved by the Pregon Historical Society and later donated to the people of the United States. The 125-acre Fort Clatsop National Memorial was authorized by Congress in 1958 to commemorate the winter encampment of the Lewis and Clark Expedition following its successful crossing of the North American Continent [116,123,133].

Table 7. Major manufacturers at Youngs Bay. [71]

| Location | Name | Type of Business | Number Employed |
|----------|---|---|-----------------|
| Astoria | Curtis Olson Logging, Inc. | Logging | 6 |
| " | Herman F. Labiske Logging | " | 1 |
| " | Johnson Logging & Dairyman, H.B. | " | 20 |
| " | Nygaard Logging Co., M. | " | 20 |
| " | W & W Logging Co. | " | 47 |
| " | Astoria Plywood Corp. | Veneer and Plywood | 235 |
| " | Mayflower Farms | Fluid milk | 9 |
| " | Barbey Packing Corp. | Canned and cured Fish and Seafoods | 50 |
| " | Bumble-Bee Seafoods-Astoria | " | 500 |
| " | Union Fishermans Coop. Pkg. Co. | " | 115 |
| " | Astoria Fish Factors Inc. | Fresh or Frozen Packaged Fish and Seafood | 25 |
| " | Astoria Seafood Co. | " | 50 |
| " | Ocean Foods of Astoria Inc. | " | 65 |
| " | Coca-Cola Bottling Co. | Bottled and Canned soft drinks and Carborated water | 7 |
| " | Van Dusen Beverages | " | 8 |
| " | Astorian-Budget Publishing Co. | Newspapers-Publishing, Publishing and Printing | 50 |
| " | Astoria Printing Co. | Books-Publishing, Publishing and Printing | 42 |
| " | Consolidated Printing and Stationery Inc. | " | 5 |

Table 7. (cont.)

| Location | Name | Type of Business | Number Employed |
|-----------|---------------------------------|--|-----------------|
| Astoria | Sunset Crushed Rock Co. | Minerals and Earths, Ground or Otherwise treated | 6 |
| " | American Can Co. | Metal cans | 15 |
| " | Phillips-Drucker Div. | Pumps, Air and Gas Compressors and Pumping Equipment | 35 |
| " | Astoria Marine Construction Co. | Shipbuilding and Repairing | 23 |
| Warrenton | Pacific Shrimp Inc. | Canned and Cured Fish and Seafoods | 17 |
| " | New England Fish Co. | Fresh or Frozen Packaged Fish and Seafoods | 45 |
| " | Bioproducts Inc. | Prepared Feed for Animals and Fowls | 50 |
| " | Warrenton Lumber Co. | Sawmills and Planing Mills | 85 |
| " | Lektro Inc. | Industrial Trucks, Tractors, Trailers, and Stackers | 20 |
| " | Carruthers Co., E.H. | Food Products Machinery | 16 |

Table 8. Surveillance Stations at Youngs Bay

| Type of Station | Name &/or Identifying number | Approximate Location | Drainage Area | Period of record | References |
|-----------------|---|--|---------------|-------------------------|------------|
| Cumatological | Astoria Experiment Station | Lat. 46° 09' Long. 123° 49' El. 48 | | 1918-1971 | [143] |
| " | Astoria WSO | Lat. 46° 09' Long. 123° 53' El. 8 | | 1953-1971 | " |
| Water Quality | N. Fork Klaskanine R. near Olney, Ore. | Lat. 46° 04' Long. 123° 42' | 14.0 | May 1950- Sept. 1954 | [145] |
| Stream Gaging | Youngs R. near Astoria | Lat. 46° 04' Long. 123° 47' | 40.1 | Aug 1929 Sept. 1958 | [147] |
| " | N. Fork Klaskanine R. near Olney, Ore. | Lat. 46° 04' Long. 123° 42' | 14.0 | Aug 1949 Sept. 1955 | [146] |
| Water Quality | Skipanon R. near Dam and 8th St. | River mile 2.2 | | | [152] |
| " | Skipanon R. near Clatsop Sta. Rd. | River mile 4.7 | | | " |
| " | Skipanon R. near Cullaby L. | River mile 7.4 | | | " |
| " | Lewis and Clark R. 1/2 mile above Peterson Slough | River mile 4.3 | | | " |
| " | Lewis and Clark R. below Klickitat Cr. | River mile 7.9 | | | " |
| " | Youngs R. near Ore. 1 Br. | River mile 9.1 | | | " |
| " | S. Fork Klaskanine R. near mouth | River mile 0.01 | | | " |
| Water Quality | N. Fork Klaskanine R. below Fish Hatchery | River mile 0.5 | | | " |
| " | N. Fork Klaskanine R. above Fish Hatchery | River mile 3.5 | | | " |

REFERENCES

1. Arnereson, R.J. "Seasonal Variation of Tidal Dynamics, Water Quality and Sediments of the Coos Bay Estuary," MS Thesis, Department of Civil Engineering, Ocean Engineering Program, Oregon State University, Corvallis, Oregon, (in preparation).
2. Bandon Chamber of Commerce, Bandon, Oregon, brochure, 1972.
3. Battelle, "An Inventory and Evaluation of Areas of Environmental Concern in Oregon for the State of Oregon Executive Department and Natural Resources Agencies." Richland, Washington, April, 1973.
4. Bell, G., ed., "Oregon Blue Book. 1971-1972," compiled and published by Clay Myers, Secretary of State, Jan., 1971.
5. Bella, D.A., "Environmental Considerations for Estuarine Benthic Systems," Water Research, Vol. 6, pp 1409-1418, 1972.
6. Bella, D.A., and Grenney, W.J., "Estimating Dispersion Coefficients in Estuaries" Technical note, Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 98, No. HY3, pp 583-589, March, 1972.
Three methods of computing one-dimensional mixing in estuaries based on salinity data are examined. The errors associated with steady state models are discussed.
7. Bourke, R.H., Glenne, B., and Adams, B.W., "The Nearshore Physical Oceanographic Environment of the Pacific Northwest Coast," Oregon State University Reference 71-45, Dept. of Oceanography, OSU, Corvallis, Ore., Feb., 1971.
8. Bowers, D., Supt., Coos Bay Sewage Disposal Plant, Coos Bay, Ore., personal communication, 1972.
9. Bureau of Governmental Research and Service, School of Community Service and Public Affairs, University of Oregon, "1940-1970 Population and Housing Trends, Cities and Counties of Oregon," Eugene, Ore., December 1971.
10. Burt, W.V., and Queen, J., "Tidal Overturning in Estuaries," Science No. 8, Vol. 126, pp 973-974, 1957.
A density overturning which provides vertical mixing during flood tide is described for Coos Bay, Oregon.
11. Burt, W.V., and Marriage, L.D., "Computation of Pollution in the Yaquina River Estuary," Sewage and Industrial Waste, Vol. 29, No. 12, pp 1385-1385, December 1957.
A one-dimensional steady state mixing model was used to compute potential pollution in the Yaquina.

12. Burt, W.V., and McAllister, B., "Hydrography of Oregon Estuaries, June 1956 to September 1958," Office of Naval Research Reference 58-6, School of Science, Oregon State College, Corvallis, Ore., 1958.
18 pp. Gives temperature and salinity data in tabulated form for Alsea, Columbia, Coos, Nehalem, Netarts, Siletz, Siuslaw, Tillamook, Umpqua, and Yaquina estuaries between June 1956 and September 1958.
13. Burt, W.V., and McAllister, W.B., "Recent Studies in the Hydrology of Oregon Estuaries," Research Briefs, Vol. 7, No. 1, Fish Commission of Oregon, July, 1959; pp 14-27.
Classifies Oregon estuaries by mixing characteristics and mentions biological applications and pollution and engineering problems.
14. Callaway, R.J., "Application of Some Numerical Models to Pacific Northwest Estuaries," Proceedings, 1971, Tech. Conf. in Estuaries of the Pac. NW. OSU, Corvallis, Ore., Eng. Expt. Stat. Circ. #42. pp 29-97, 1971.
15. Callaway, R.J., "Physical and Chemical Oceanographic Data, Umpqua River Estuary, Ore. Part II: January 25-26, 1961," U.S. Dept. of HEW, Portland, Ore., Feb., 1961.
9 pp Abstract: "Oceanographic data collected in the Umpqua River Estuary, Oregon, during the period January 25-26, 1961 are tabulated. Temperature, salinity, velocity, and dissolved oxygen were observed at various depths over the tidal cycle at one station. Temperature and salinity observations were made from the ocean to 11.5 miles upstream upon completion of the 25-hour station. A brief discussion of results is presented."
16. Callaway, R.J., "Physical and Chemical Data, Umpqua River Estuary, Oregon, Part III: March 21-22, 1961," U.S. Dept. of HEW, Portland, Ore., April, 1961.
6 pp. and tables. Abstract: "Oceanographic data collected in the Umpqua River Estuary, Oregon during the period March 21-22, 1961, are tabulated. Temperature, salinity, velocity, and dissolved oxygen were observed at various depths over one tidal cycle at a mid-channel anchor station located near the mouth of the river."
17. Callaway, R.J., "Physical and Chemical Oceanographic Data, Umpqua River Estuary, Oregon, Part IV: April 26-27, 1961," U.S. Dept of HEW, Portland, Ore., May, 1961.
4 pp. and tables. Abstract: "Oceanographic data collected in the Umpqua River Estuary, Oregon, during the period April 26-27, 1961, are tabulated. Temperature, salinity, velocity, and dissolved oxygen were observed at various depths over one tidal cycle at a mid-channel anchor station located near the mouth of the river."
18. Callaway, R.J., Ditsworth, G.R., and Cutchin, D.L., "Salinity, Runoff, and Wind Measurements, Yaquina Estuary, Oregon," April, 1967-October 1968. Working Paper No. 70. FWQA, Pacific NW Water Lab., Corvallis, Ore., 42 pp., 1970.
19. Capman, D.W., Corliss, J.F., Phillips, R.W., and Demory, R.L., "Alsea Watershed Study," Miscellaneous Paper No. 110, Oregon Agricultural Experiment Station, Corvallis (?), Ore., April, 1961.

20. Case, E., Fish Commission of Oregon, Portland, Ore., personal communication, 1972.
21. City of Waldport, Waldport, Ore., personal communication, 1972.
22. Cole, D.L., Curator, Museum of Natural History, University of Oregon, Eugene, Ore., personal communication, Nov., 9, 1972.
23. Columbia--North Pacific Technial Staff, Pacific Northwest River Basins Commission, "Water Resources Appendix V, Columbia--North Pacific Region, Comprehensive Framework Study, Vol. 2, Sub-regions 7-12," Vancouver, Wash., April, 1970.
24. Coos Bay Area Chamber of Commerce, Coos Bay, Ore., brochure, 1972.
25. Coquille Chamber of Commerce, Coquille, Ore., map and brochure, 1972.
26. Cornell, Howland, Hayes, and Merryfield, "Umpqua River Gravel Study," for the Umpqua River Navigation Co., Eugene, Ore., June, 1971.
22 pp. A study of six-mile stretch of the Umpqua River just downstream from Scottsburg to determine whether the natural deposits of gravel within the study area are naturally replenished after being removed for commercial purposes.
27. Correspondence by mail with Glenn J. Akins, Planning Coordinator, Oregon Coastal Conservation and Development Commission, 519 Coast Highway, P.O. Box N, Florence, Ore., 97439. Telephone 997-8248.
28. Deahl, R., Fish Commission of Oregon, Portland, Ore., personal communication, March, 1973.
29. Dept. of Civil Engineering, OSU, "Tidal Flats in Estuarine Water Quality Analysis," progress report, research grant WP-01385-01, Federal Water Pollution Control Administration, Sept. 30, 1969.
45 pp. Describes the tidal flat system; gives data on benthal oxygen uptake, free sulfides in overlying water, particle sizes, volatile solids, and salinity profiles.
30. Ditsworth, G.R., "Environmental Factors in Coastal and Estuarine Waters," Bibliographic Series, Vol. I, Federal Water Pollution Control Administration, Publication WP-20-2, 61 pp, October, 1966.
References to literature pertaining to the marine waters of Oregon are provided.
31. Division of State Lands, copy of a public notice concerning dredging of Isthmus Slough, Salem, Ore., July 3, 1972 (mimeo).
32. Fisacherly, G.M., "Estuary Entrance, Umpqua River, Oregon," Technical Report H-70-6, U.S. Army Engineer District, Portland, Ore., May, 1970.
20 pp. plus 263 tables, photographs, and plates. Using an Umpqua River Estuary model capable of reproducing and measuring tides, tidal currents, waves, salinity intrusion, fresh water inflow, and shoaling distribution, the optimum plan for the reduction of shoaling and the elimination of cross currents in the navigation channel at the entrance was determined.

33. Fish Commission of Oregon, "Biennial Report, 1968-1970," Salem, Ore.
Describes the organization of the FCO, its regulatory actions concerning foodfish resources, and its various research programs. Also gives tables showing the following: financial statement, commercial fish landings in Oregon, information on licenses issued, and statistics of hatchery returns, egg take, and salmon and steelhead liberations.
34. Fish Commission of Oregon, tables giving fish landings received at Oregon ports with the value to fishermen for 1971, Portland, Ore., April, 1, 1972.
2 pp. Table.
35. Florence Area Chamber of Commerce, Florence, Ore., brochure, 1972.
36. Florence sewage treatment plant, Florence, Ore., personal communication, 1972.
37. Frolander, H.F., Flynn, M.J., Spring, C.S., Zimmerman, S.T., and Miller, C.B., "Yaquina Bay Zooplankton Survey I," Data Report 48, reference 71-21, Department of Oceanography, Oregon State University, Corvallis, Ore., pp 27, August, 1971.
Report provides 7 1/2 years of data on zooplankton, temperature dissolved oxygen and salinity within Yaquina Bay.
38. Gaumer, T., Demory, D., Osis, L., 15 reports on Estuarine Resources use now in printing, by Fish Commission of Oregon.
39. Giger, R.D., "Some Estuarine Factors Influencing Ascent of Anadromous Cutthroat Trout in Oregon," Proceedings of the 2nd Annual Conference on Estuaries of the Pacific Northwest, Oregon State University, Corvallis, Ore., March, 1972.
40. Gladwell, J.S., and Tinney, E.R., "Umpqua Estuary Model Study," Washington State Institute of Technology Bulletin 265, Pullman, Wash., Aug., 1962.
107 pp. Describes the Umpqua model (equipped for accurate reproduction and measurement of prototype phenomena) used for pollution tests.
41. Glanzman, C.F., Glenne, B., Burgess, F.J., "Tidal Hydraulics, Flushing Characteristics, and Water Quality of Coos Bay," Engineering Experiment Station, Oregon State University, Corvallis, Ore., pp 103, Jan., 1971.
This report studies the mixing characteristics of Netarts Bay with emphasis given to potential pollution impacts.
42. Goodwin, C.R., "Estuarine Tidal Hydraulics--One-Dimensional Model and Predictive Algorithm," PhD Thesis, Department of Civil Engineering, Ocean Engineering Program, Oregon State University, Corvallis, Ore., (in preparation).
This study provides a calibrated numerical tidal hydraulic model of the Alsea, Siletz and Yaquina.
43. Goodwin, C.R., Emmet, E.W., and Glenne, B., "Tidal Study of Three Oregon Estuaries," Bulletin No. 45, Engineering Experiment Station, OSU, Corvallis, Ore., May, 1970.
33 pp. Discusses tidal elevations and tidal currents in Yaquina, Alsea, and Siletz estuaries.

44. Gray, C., U.S. Dept. of Environmental Quality, Portland, Ore., personal communication, 1972.
45. Haas, J., Fish Commission of Oregon, Portland, Oregon, personal communication, Feb. 27, 1973.
46. Hamilton, S., Division of State Lands, Salem, Ore., personal communication, 1972.
47. Hansen, D.V., and Rattray, M., "New Dimensions in Estuary Classification," Limn. and OCEAN, 11(3), 319-326, 1966.
48. Hart, L., Toledo City Manager, Toledo, Ore., personal communication, 1972.
49. Helland, R.O., "Water Power of the Coast Streams of Oregon," U.S. Dept. of the Interior, Feb., 1953.
46 pp. Gives a general description of Oregon coastal streams and discusses them in terms of water supply and storage sites and plan of development, with conclusions regarding potential for power. Includes the Nehalem River, Wilson and Trask Rivers (Tillamook Bay), Nestucca River, Siletz River, Alsea River, Siuslaw River, Coos River, and Coquille River.
50. Hopman, R., U.S. Army Corps of Engineers, Portland, Ore., personal communication, 1972.
51. Interstate Electronics Corporation and Environmental Production Agency, "Coastal Zone Water Quality Monitoring in Oregon and Washington," by D.A. Milne, Report -45-B6, April, 1973.
52. Jacobson, L., Oregon State Highway Division, Salem, Ore., personal communication, August 8, 1972.
53. James, W., "A Photographic Analysis of Oregon Estuaries," Dept. of Civil Engineering, OSU, Corvallis, Ore., 1970(?).
72 pp. Includes general descriptions, photographs, and photographic analyses of the following Oregon estuaries: Tillamook, Alsea, Coos, Umpqua, Siletz, Siuslaw, Nestucca, Nehalem, Coquille, Salmon River, Sand Lake, Netarts, and Yaquina.
54. Jefferies, E., Fish Commission of Oregon, Portland, Ore., personal communication, March, 1973.
55. Johnson, J.W., "Tidal Inlets on the California, Oregon, and Washington Coasts," Hydraulic Engineering Laboratory HEL 24-12, Univ. of Calif., Berkeley, Calif., Feb., 1972.
56 pp. Discusses factors affecting the stability of tidal inlets and gives characteristics of California, Oregon, and Washington coastal inlets including number of jetties, tidal data, bay dimensions, and wave climate.
56. Kernan, G., Oregon State Game Commission, Portland, Oregon, personal communication, March, 1973.

57. Klingeman, P.C., et. al., "Coastal Processes--Oregon Coastal Littoral Drift," Marine Geotechnique Preliminary Study, OSU, Corvallis, Ore., 1969 (mimeo report).
Glass papers from CE 572 (Dept. of Civil Engineering) on littoral drift along the Oregon coast with bibliographies.
58. Lower Umpqua Chamber of Commerce, Reedsport, Ore., brochure and personal communication, 1972.
59. Marriage, L.D., "The Bay Clams of Oregon," Fish Commission of Oregon, Educational Bulletin #2, Portland, Ore., 1958.
29 pp. Describes the various types of clams generally found in Oregon estuaries and also lists the types present in each specific estuary. Also gives estuary surface areas.
60. Matson, A.L., "Zooplankton and Hydrography of Alsea Bay, Oregon, September 1966 to September 1968," thesis presented to Oregon State University at Corvallis, Ore., in June, 1972, in partial fulfillment of the requirements for the degree of Doctor of Philosophy.
61. McAllister, W.B., and Blanton, J.O., "Temperature, Salinity and Current Measurements for Coos Bay, Oregon," Data Report No. 10, Reference 63-23, Department of Oceanography, Oregon State University, Corvallis, Ore., pp 33, October, 1963.
Temperature, salinity and current measurements extending over one or more tidal cycles were made at various times during the three year period 1960-1963.
62. McKenzie, D.R., "Seasonal Variation of Tidal Dynamics, Water Quality and Sediments of the Alsea Estuary," MS Thesis, Department of Civil Engineering, Ocean Engineering Program, Oregon State University, Corvallis, Oregon.
63. Murphy, K., Reedsport Sewage Treatment Plant, Reedsport, Ore., personal communication, Nov. 14, 1972.
64. Newport Sewage Treatment Plant, Newport, Ore., personal communication, 1972.
65. North Bend Sewage Treatment Plant, North Bend, Ore., personal communication, 1972.
66. Oregon Coastal Conservation and Development Commission, "Coastal Wetlands of Oregon," August, 1973.
159 pp. Includes descriptions, management practices, and an inventory of Oregon's wetlands.
67. Oregon Dept. of Environmental Quality, "An Informational Guide for Interpreting Oregon Estuary Data," Oregon State Sanitary Authority, 1969, (mimeo).
68. Oregon Dept. of Environmental Quality, water quality data from estuarine surveillance stations, Portland, Ore., 1972.

69. Oregon Division of State Lands, Inventories of filled lands is Alsea, Nehalem, Nestucca, Salmon, Sand Lake, Siuslaw, Tillamook, Umpqua, and Yaquina Estuaries (separate reports), Salem, Ore., 1972.
Each report gives a brief description of the estuary and drainage basin; map of the estuary with landfill locations; individual maps of the parcels on which landfills are located; and tables showing parcel ownership, date filled, construction dates, usage (past and present), permit information and fill acreage.
70. Oregon Division of State Lands, preliminary information for wetlands reports to be printed in March, 1973, Salem, Ore.
3 pp. Gives material on the following estuaries: Tillamook, Netarts, Sand Lake, Nestucca, Siuslaw, Salmon, Umpqua, Nehalem, Yaquina, Alsea, and Siletz including MHT and MLT surface areas, ownership and deed information, drainage basin area, fresh water yield, and the amount of accretion at jetties.
71. Oregon Economic Development Division, "Directory of Oregon Manufacturers, 1972," Portland, Ore.
Lists the names of all Oregon manufacturing establishments alphabetically, by location, and according to their Standard Industrial Classification (SIC) code with information such as address, phone number, head, products, and number employed.
72. Oregon State Department of Geology and Mineral Industries, "Geology of the Southwestern Oregon Coast West of the 124th meridian," Bulletin 69, 1971.
63 pp. Describes Tectonic settings, rock types and formations, and economic geology of the area.
73. Oregon State Division of State Lands Tideland Ownership Maps. Tideland Maps compiled from May 1970 and January 1971 aerial photography, 1973.
74. Oregon State Division of State Lands, "Oregon Estuaries," Salem, Ore., June, 1973.
General descriptions and maps of Oregon's estuaries.
75. Oregon State Game Commission, "Environmental Investigations. Mid-Coast Basin" Portland, Ore., March, 1972.
98 pp. See [79].
76. Oregon State Game Commission, "Environmental Investigations. North Coast Basin," Portland, Ore., 1968.
102 pp. Describes fish and game resources of the North Coast Basin and a streamflow study with recommended minimum flows for fish life, miscellaneous flow and temperature (air and water) measurements, and biological requirements of fish.
77. Oregon State Game Commission, "Environmental Investigations. North Coast Basin. Supplement," Portland, Ore., Jan., 1972.
52 pp. Reviews recreational uses and economic considerations of the fish and wildlife resources of the North Coast Basin. Shellfish and commercial harvest data provided by the FCO.
78. Oregon State Game Commission, "Environmental Investigations. South Coast Basin," Portland, Ore., April, 1972.
98 pp. See [79].

79. Oregon State Game Commission, "Environmental Investigations. Umpqua River Basin," Portland, Ore., Feb., 1972.
127 pp. Discusses fish and game resources, a streamflow study with recommended minimum and optimum streamflows for fish life, and fish and wildlife importance. Includes table and maps.
80. Oregon State Game Commission, Fishery Division, "1970 Annual Report," C.J. Campbell and F.E. Locke, ed., Salem(?), Ore.
Included numerous table (e.g., fish counts, trap-net and gill-net collections, catch statistics, anadromous fish counts, angler success) and also gives hatchery names, fish distribution and propagation, Fishery Div. expenditures, habitat improvements, Oregon salmon and steelhead sport catch.
81. Oregon State Game Commission, Portland, Ore., mimeo reports on Coquille, Rogue, and Chetco Rivers to be used in the OSGC 1972 publication, "Environmental Investigations. South Coast Basin."
Describes the three above-mentioned areas in terms of wildlife and industrial uses.
82. Oregon State Highway Division, State Parks and Recreation Section, "Day-Visitors--Attendance," Salem, Ore., Sept., 1971 (mimeo).
3 pp. Lists the annual number of day visitors at Oregon State parks for 1966-67 through 1970-71.
83. Oregon State Highway Division, State Parks and Recreation Section, "Overnite Camping by the Public," Salem, Ore., Oct., 1971 (mimeo).
2 pp. Lists annual number of camper nights spent at Oregon State campgrounds for 1966-67 through 1970-71.
84. Oregon State Sanitary Authority, "Water Quality Control in Oregon," Portland, Ore., 1966-67, Vol. I, 113 pp., Vol. II, 29 pp., Vol. II, supplement, 65 pp.
Summary of Oregon's Air and Water Quality Control Programs for 1966-67.
85. Oregon State University, Corvallis, Ore., "Dredge Spoil Distribution and Estuarine Effects," Research proposal submitted to NSF, May 28, 1971.
86. Oregon State University, Department of Oceanography, "Comprehensive Inventory of Scientific Information Relating to the Physical and Biological Characteristics of the Estuaries of Oregon," preliminary proposal, Corvallis, Ore., March, 1971.
87. Oregon State University, Water Resources Research Institute, Data Collection during July and August, 1973 by Chet Sutterlin, Civil Engineering, and Steve Klug, Fisheries.
88. Oregon State Water Resources Board, "Mid-Coast Basin," Salem, Ore., May, 1965.
121 pp. Describes the Mid-Coast Basin, including the Salmon, Siletz, Yaquina, Alsea, Yachats, and Siuslaw Rivers and their drainage basins, as follows: physical features, economic factors, surface water and ground water, water use and associated problems, water control, and developmental potential. Includes maps.
Work on an updated version is underway and scheduled for publication in 1974.

89. Oregon State Water Resources Board, "North Coast Basin," Salem, Ore., June, 1961.
142 pp. See [88].
90. Oregon State Water Resources Board, "North Coast Basin Hydrological Summary 1.200-5," Salem, Ore., May, 1961.
22 pp. Listing of stream gaging stations, water temperature stations and climatological stations with locations, USGS number, name, drainage area, gage-type, period of record, and other information. Also names agencies having stream gaging, water temperature, water quality, and climatological records.
91. Oregon State Water Resources Board, "North Coast Basin Recreation Areas Summary," Salem, Ore., June, 1961.
9 pp. Lists North Coast Basin forest camps, state parks, roadside rest areas, county parks, and boat landings shown on the OSWRB chart #1.70146/107.
92. Oregon State Water Resources Board, "Precipitation Stations--Oregon. Monthly Precipitation Records on Punch Cards by Calendar and Water Year through September 1967," Salem, Ore., 1968.
41 pp. Describes format used in recording precipitation records available in punch card or printout form. Records are to be updated.
93. Oregon State Water Resources Board, "South Coast Basin," Salem, Ore., Jan., 1963.
125 pp. Gives descriptions of the South Coast Basin (Coos, Coquille, and Chetco River areas) as in [26].
94. Oregon State Water Resources Board, "Stream Mile Summary. Mid-Coast Basin," Salem, Ore., 1967.
29 pp. See [95].
95. Oregon State Water Resources Board, "Stream Mile Summary. North Coast Basin," Salem, Ore., 1967.
24 pp. Lists stream systems and coordinates stream miles of major rivers with landmarks.
96. Oregon State Water Resources Board, "Stream Mile Summary. South Coast Basin," Salem, Ore., 1967.
17 pp. See [95].
97. Oregon State Water Resources Board, "Stream Mile Summary. Umpqua Basin," Salem, Ore., 1967.
25 pp. See [95].
98. Oregon State Water Resources Board, "Surface Water Gaging Stations, Oregon," Salem, Ore., 1968.
Describes the format used in recording monthly and water-year runoff records from certain surface-water gaging stations with a listing of stations including locations and periods of record. Data can be obtained in either punch card or printout form from the OSWRB at cost.
99. Oregon State Water Resources Board, "Umpqua River Basin," Salem, Ore., July, 1958.
182 pp. See [88].

100. Payne, E.W., Harbormaster, Port of Coos Bay, Coos Bay, Ore., personal communication, 1972.
101. Pierce, D., Bandon Sewage Treatment Plant, Bandon, Ore., personal communication, Nov. 14, 1972.
102. Port of Alsea, Waldport, Ore., personal communication, 1972.
103. Port of Bandon, Bandon, Ore., personal communication, 1972.
104. Port of Nehalem, Nehalem, Ore., personal communication, 1972.
105. Port of Newport, Newport, Ore., personal communication, 1972.
106. Port of Portland, "Oregon Port Directory," Feb., 1972.
16 pp.
107. Port of Siuslaw, Florence, Ore., personal communication, 1972.
108. Port of Tillamook Bay, Tillamook, Ore., personal communication, 1972.
109. Port of Toledo, Toledo, Ore., personal communication, 1972.
110. Port of Umpqua, Reedsport, Ore., personal communication, 1972.
111. Rand McNally and Co., 1972 Commercial Atlas and Marketing Guide, R.L. Forstall, ed., Chicago, Ill., 1972.
112. Rauw, C.I., "Seasonal Variation of Tidal Dynamics, Water Quality and Sediments of the Siletz Estuary," MS Thesis, Department of Civil Engineering, Ocean Engineering Program, Oregon State University, Corvallis, Oregon.
113. Renfro, W.C., McCauley, J.E., Glenne, B., Bourke, R.H., Hancock, D.R., and Hager, S.W., "Oceanography of the Nearshore Coastal Waters of the Pacific Northwest Relating To Possible Pollution (Parts I and II)," Environmental Protection Agency, Water Quality Office, 16070 EDK 07/71, 744 pp., July, 1971.
This report provides an extensive review of the Pacific Northwest Nearshore Oceanography. Numerous references are provided.
This report may be cataloged under the Environment Protection Agency as the authors names were not included due to a policy of EPA.
114. Siletz Bay Regional Planning Advisory Committee, minutes of monthly meetings, July 5, 1972, Siletz, Ore.
115. Simmons, H., "The Potential of Physical Models to Investigate Estuarine Water Quality Problems," Proceedings, 1971 Technical Conference on Estuaries of the Pacific Northwest, OSU, Corvallis, Ore., Engineering Expt. Station Circular No. 42, 1971, pp. 4-28.
Describes existing physical models of Columbia River, Umpqua, Grays Harbor, and Tillamook estuaries and gives their uses.

116. State of Oregon, Department of Geology and Mineral Industries, "Environmental Geology of the Coastal Region of Tillamook and Clatsop Counties, Oregon," Bulletin 74, Portland, Ore., 1972.
164 pp. Describes geography, geologic units, economic mineral resources, engineering characteristics of geologic units, and geologic hazards.
117. Stevens, Thompson, and Runyan, Inc., "Coos-Curry Environmental Protection Program," 1980 interim sewerage plan for the Coos Bay/ Coos River Basin and Chetco River Basin for the Coos-Curry Council of Governments, Feb., 1971.
118. Snow, D., Fish Commission of Oregon, Newport, Ore., personal communication, Oct. 4, 1972.
119. Summers, V.C., and Neubauer, E.K., "Closing Report for the Coastal Stream Improvement and Rehabilitation Program," Fish Commission of Oregon, Portland, Ore., March, 1965.
120. Thomas J. Murray and Associates, "Development Program for Tillamook Bay, Oregon," for Tillamook County, Port of Bay City, and Port of Tillamook Bay, Ore., July, 1972.
81 pp. A study to investigate a development program for Tillamook Bay following completion of the new south jetty.
121. Tillamook Chamber of Commerce, Tillamook, Ore., brochures, 1972.
122. University of Oregon, Bureau of Government Research and Service, "Preliminary Land Use Plan for the Yaquina Bay Area," for the Yaquina Bay Planning Commission, 1969.
123. U.S. Army Corps of Engineers, Final Environmental Statement, "Dredging of Lewis and Clark Connecting Channel, Clatsop County, Oregon," Portland, Ore., June, 1973.
Includes proposed action, existing conditions, environmental impact, alternatives, and coordination of the project.
124. U.S. Army Corps of Engineers, gradation curves from the North Pacific Division Testing Laboratory, Portland, Ore., 1958 to 1972.
Results of analyses of dredge samples from Siuslaw River, Tillamook Bay, Rogue River, Chetco River, Columbia River, Baker Bay (Washington), Yaquina Bay, Umpqua River, Coquille River, and Coos Bay. Includes information on sieve analyses, void ratios, densities, percent organic material, and roundness grade.
125. U.S. Army Corps of Engineers, North Pacific Division, "National Shoreline Study, Inventory Report Columbia--North Pacific Region, Washington and Oregon," August, 1971.
80 pp. Describes physical characteristics, changes, littoral drift, ownership, and use of the Washington and Oregon shorelines.
126. U.S. Army Corps of Engineers, "Oregon Coastal Harbors," Portland, Ore., 1968.
4 pp. Briefly describes jetty and channel projects at Oregon Estuaries.
127. U.S. Army Corps of Engineers, "Shore Protection, Planning and Design," Technical Report No. 4, U.S. Government Printing Office, Washington, D.C., 1966.

128. U.S. Army Corps of Engineers, "Study of Hopper Dredging Coastal Harbor Entrances and Columbia River Estuary Bars, States of Oregon and Washington," Portland, Ore., Nov., 1971.
293 pp. Gives detailed descriptions of dredging projects at Tillamook, Yaquina, Siuslaw, Umpqua, Coos, Coquille, Rogue, and Chetco including history, status, and use.
129. U.S. Army Corps of Engineers, "Water Resources Development by the U.S. Army Corps of Engineers in Oregon," North Pacific Division, Portland, Ore., 1971.
(1971--149 p.) Published biennially since 1955. Gives multiple purpose development, navigation development, and flood control developemnt information by the U.S. Army Corps of Engineers in Oregon.
130. U.S. Coast and Geodedic Survey, charts, published at Washington, D.C. by the U.D. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey, 1970, 1971, and 1972.
131. U.S. Department of Agriculture, "USDA Report on Water and Related Land Resources, South Coast Drainage Basin, Oregon," Feb., 1962.
120 pp. Includes description, forest management, agriculture, recreation, and water related problems and opportunities of the basin.
132. U.S. Department of Agriculture and Oregon Agricultural Experiment Station, "Soil Survey of Curry Area, Oregon," Jan., 1970.
70 pp. Soil maps, descriptions, use and management, formation and classification, labratory data, and general nature of the area of Curry County, Oregon.
133. U.S. Dept. of Agriculture, Oregon River Basin Survey Staff, "USDA Report on Water and Related Land Resources, North Coast Drainage Basin, Oregon," Salem, Ore., June, 1966.
148 pp. Includes descriptions, forest management, agriculture, recreation, and water related problems and opportunities of the basin.
134. U.S. Department of Commerce, Bureau of Census, "Number of Inhabitants, Oregon," July, 1971.
33 pp. Population data for Oregon.
135. U.S. Department of the Interior, EROS Data Center, Sioux Falls, South Dakota, 57198. Aerial photographs from NASA-Ames Reserach Center, May 11, 1973, Roll 73-074B, Accession Number 01171, Frames 1247, 1277, 1281, and 1284.
136. U.S. Dept. of the Interior, Federal Water Pollution Centrol Administration, "Report of the Committee on Water Quality Criteria," Washington, D.C., April, 1968.
137. U.S. Dept. of the Interior, Fish and Wildlife Service, "Fish and Wildlife of Yaquina Bay, Oregon," Portland, Ore., Nov., 1968.
23 pp. A special report on a preliminary survey organized as follows:
Part I. Some Ecological and Biological Aspects of Yaquina Bay-Estuary;
Part II. An Evaluation of Fish and Wildlife Resources of Yaquina Bay;
Part III. Factors Affecting Fish and Wildlife Utilization and Value of Yaquina Bay Recommendations. Includes maps showing eel grass and oyster locations and clam, fish, and wildlife habitats.

138. U.S. Dept. of the Interior, Geological Survey, "Compilation of Water Temperature Data for Oregon Streams," Portland, Ore., 1964.
134 pp. Gives the monthly mean, maximum, and minimum water temperature for all years of record through 1962. Also includes station locations, drainage areas, and periods of record.
139. U.S. Dept. of the Interior, Geological Survey, "Water Quality Records in Oregon," Portland, Ore., 1964.
134 pp.
140. U.S. Dept. of the Interior, Geological Survey, "Water Resources Data for Oregon, Part I. Surface Water Records," Portland, Ore., 1970.
Annual publications in which daily flow rates recorded at Oregon stream gaging stations during the year are given. Also include the station locations, drainage areas, and periods of record with the average discharge and extreme flow rates for the year and for the period of record.
141. U.S. Dept. of the Interior, Geological Survey, "Water Resources Data for Oregon, Part II. Water Quality Records," Portland, Ore., 1966, 1967, and 1968.
(1968--143 pp.) Annual publications in which daily maximum and minimum water temperature recorded at Oregon stations during the year are given. Also include the station locations, drainage areas, and periods of record with extremes for the year and for the period of record and daily suspended sediment and mean daily discharge. For some years (approximately from 1964 to 1967), sediment size analyses are given.
142. U.S. Dept. of the Interior, "Natural Resources, Ecological Aspects Uses and Guidelines for the Management of Coos Bay, Oregon," Special Report, June, 1971.
This is a comprehensive report which discusses the Coos Bay ecosystem, man's impact, insitutional management, planning guidelines and recommendations.
143. U.S. Environmental Data Service, "Hourly Precipitation Data, Oregon," Vo. 1-, Ashville, N.C., 1951-.
Gives hourly precipitation and monthly totals measured at recording stations throughout Oregon. Tables.
144. U.S. Geological Survey Quadrangel Maps. Gold Beach, 1954; Mt. Emily, 1954; Cape Blanco, 1954; Langlois, 1954.
145. U.S. Geological Survey--Water Supply Paper 1353, "Quality of Surface Waters of the United States 1954," Parts 9-14.
146. U.S. Geological Survey--Water Supply Paper 1398, "Surface Water Supply of the United States, 1955," Part 14.
147. U.S. Geological Survey--Water Supply Paper 1568, "Surface Water Supply of the United States, 1958," Part 14.
148. U.S. Geological Survey--Water Supply Paper 2135, "Surface Water Supply of the United States, 1966-1970," Part 14.

149. U.S. Siuslaw National Forest Service, "Cascade Head-Salmon River Land Use and Ownership Plan," Pacific Northwest Region, Forest Service, USDA, June 22, 1972.
70 pp. Recommendations assembled after public meetings held to discuss the possibility of including the Cascade Head-Salmon River area on the Siuslaw National Forest.
150. U.S. Siuslaw National Forest Service, "Cascade Head-Salmon River Study Area," 1972.
5 pp. Report, assembled prior to public meetings, describing the Cascade Head-Salmon River area in terms of ownership, uses, fish and wildlife, timber and vegetation, community development, history, geology, surface drainage, soils and slope.
151. Utt, M.E., "Seasonal Variation of Tidal Dynamics, Water Quality and Sediments of the Siuslaw Estuary," MS Thesis, Department of Civil Engineering, Ocean Engineering Program, Oregon State University, Corvallis, Oregon, (May 1974).
152. Visit to DEQ lab, Warren C. Westgarth, PhD., Administrator, 8148 S.W. Beaverton-Hillsdale Highway, Beaverton, Ore., December 13, 1973.
153. Waldport Community Chamber of Commerce, Waldport, Ore., brochure and personal communication, 1972.
154. Walker, D., Preliminary data, "Invertebrates of Yaquina Bay, 1971-72; from marker buoy 36 to 1.5 miles above marker buoy 47," Oregon State University Marine Science Center, Newport, Ore., 1972.
155. Wick, W.Q., "Crisis in Oregon Estuaries," OSU Sea Grant Extension Marine Advisory Program, Newport, Ore., May, 1970.
8 pp. Gives a brief description of the major Oregon estuaries and the possible crises occurring at each.

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